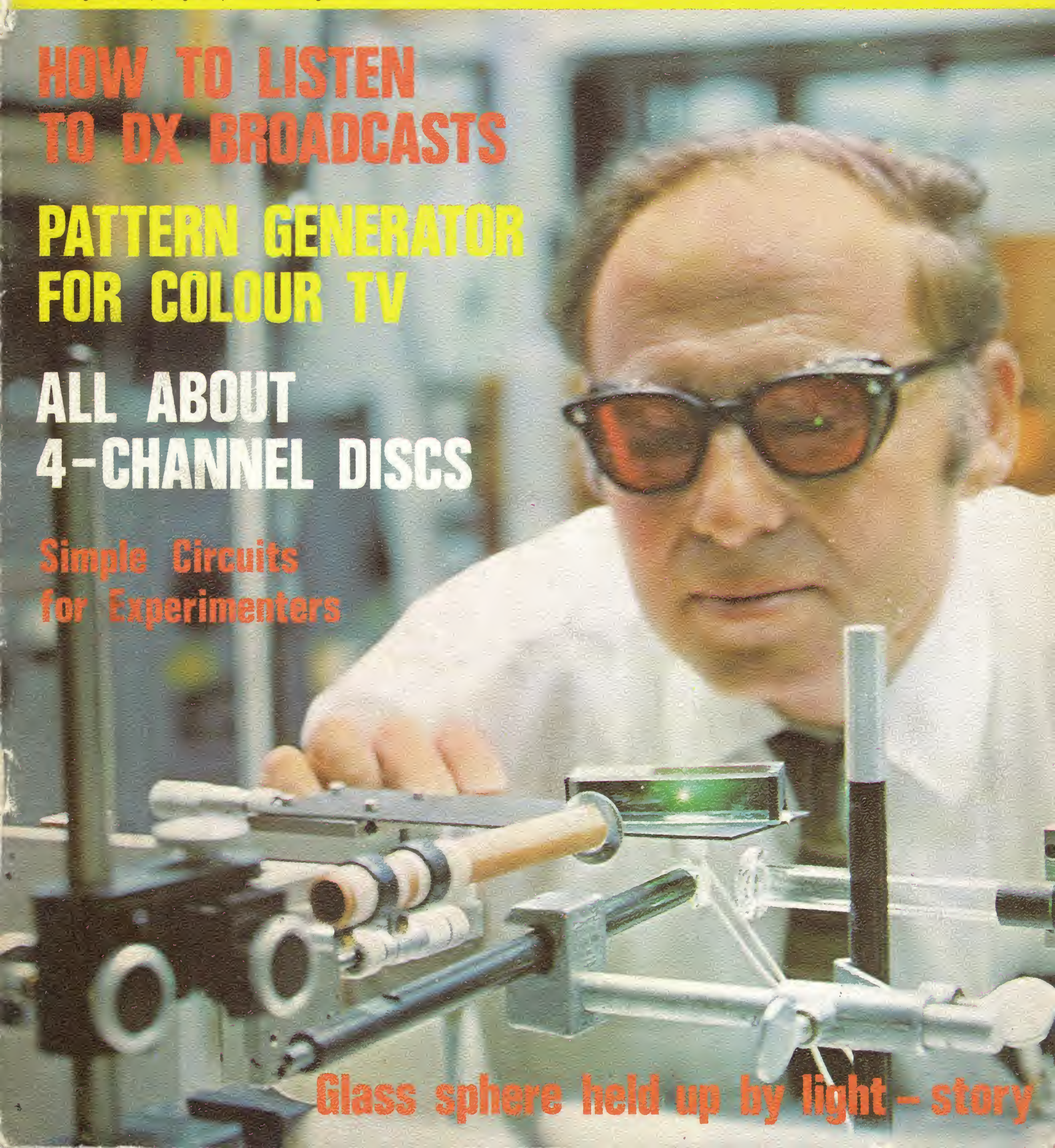
MAY, 1972 AUSTRALIA'S LARGEST-SELLING ELECTRONICS & HI-FI MAGAZINE

ELECTRONICS Australia

50c* Fiji and New Guinea 60c
Malaysia $2.50
N.Z. 60c

Registered for posting as a periodical — Category B



HOW TO LISTEN TO DX BROADCASTS

PATTERN GENERATOR FOR COLOUR TV

ALL ABOUT 4-CHANNEL DISCS

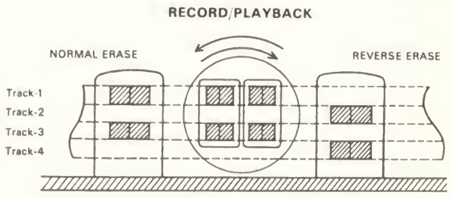
Simple Circuits for Experimenters

Glass sphere held up by light — story

revolutionary!

Sony's TC-440 introduces the unique Roto-Bilateral Head

Here is a remarkable machine with unique advantages. With Sony's revolutionary Roto-Bilateral head matching record and playback characteristics in both directions are obtained. There are fewer bias and record level adjustments, less modulation noise assured by the narrow tape loop span of only 80 mm. Conventional 4-track stereo reverse tape recorders have used a pair each of erase, record and reproduction heads, one for tracks 1 and 3 and the other for tracks 2 and 4. This system, however, has the disadvantage of causing each tape direction to have different recording characteristics. On the Tc-440 the total head assembly consists of two erase heads, one for each direction of tape travel, and in the centre, a rotary ROTO-BILATERAL HEAD consisted of separate record and playback heads. This head automatically rotates 180 degrees and reverses the record and playback heads when the tape's travelling direction is switched. A mechanical locking device guarantees perfect alignment of the ROTO-BILATERAL HEAD in either position. Plus auto reverse, auto shut-off, sound on sound, echo and many other professional-standard features. About $499.



SPECIFICATIONS

System:	4-track 2-channel stereo/mono recording and playback	
Power requirements:	AC 100, 110, 120, 127, 220 or 240V (selectable with voltage selector) 50/60Hz (no need to change)	
Power consumption:	AC 45W	
Tape speeds:	7½, 3¾ and 1⅞ips (19, 9.5 and 4.8cm/s)	
Reel capacity:	7" (178mm) or smaller	
Frequency response:	NORMAL	SPECIAL
at 7½ ips	20 – 25,000Hz	20 – 30,000Hz
at 7½ ips	30 – 20,000Hz ±3dB	30 – 25,000Hz ±3dB
at 3¾ ips	20 – 17,000Hz	20 – 23,000Hz
at 1⅞ ips	30 – 9,000Hz	

Signal-to-noise ratio:	Better than 53dB (NORMAL) Better than 56dB (SPECIAL)
Flutter and wow:	Less than 0.06% at 7½ ips Less than 0.1% at 3¾ ips Less than 0.2% at 1⅞ ips
Harmonic distortion:	Less than 1.2% at normal recording level
Level indicator:	Separate level meters
Recording time (on 1,800ft tape):	Stereo: 6 hours at 1⅞ ips Mono: 12 hours at 1⅞ ips
Fast forward and rewind time: (with 1,800ft tape)	2 min. 50 sec.
Inputs:	Microphone

SONY®

JACOBY KEMPTHORNE

SYDNEY: 26 2651, MELBOURNE: 329 6866, ADELAIDE: 93 2388/9, BRISBANE: 44 4488, PERTH: 28 5725, LAUNCESTON: 25 322, Agents: CANBERRA: 47 9010, NEWCASTLE: 61 4991, FAIRY MEADOW: 84 8022.

For further information please fill in the Reader Information Service coupon in this issue

SN3316

ABC certified circulation in excess of 48,000

Readership in Sydney, Melbourne, Brisbane, Adelaide and Perth 211,000 (McNair National Readership Survey, May-September 1971)

ELECTRONICS Australia

Incorporating "RADIO, TELEVISION and HOBBIES" and "MODERN WORLD"

AUSTRALIA'S LARGEST-SELLING ELECTRONICS & HI-FI MAGAZINE

VOLUME 34, NO 2

USEFUL FOR COLOUR TV. The sync and pattern generator described in the article beginning page 32 can also be used for testing and adjusting colour TV convergence.

QUADRAPHONIC SOUND. Four-channel discs are now available on the Australian market. If you feel tempted to go out looking for the hardware which will play these new discs, read the article beginning on page 24 before committing yourself.

INTERESTED IN DX? In this issue we provide the information you need to have to get started in the hobby of DX listening (page 44). A directory of DX receivers is also provided (page 48).

On the cover

Scientists at the Bell Laboratories in the USA have succeeded in supporting a small sphere of glass by a beam of light from a laser. The cover picture shows Dr Arthur Ashkin, one of the Bell scientists who conducted the experiment, adjusting the equipment. See also the story "Laser Light Lifts Glass" on page 31.

CONTENTS — MAY, 1972

world of electronics and hi-fi

projects and technical

regular features

EDITORIAL VIEWPOINT

Computers: some rethinking needed

Computer engineers, business automation experts, system analysts and various other people in the EDP industry frequently make the plea that computers are unjustly blamed for errors, misunderstood, and generally unloved by an unappreciative public. No doubt there is a lot of truth in these claims. But it is also true that much of the blame for the somewhat tarnished image of the computer in the eyes of the public can be laid squarely back at the doorstep of its professional guardians and entrepreneurs.

It is easy enough to point out that the average citizen is painfully ignorant of computer system operation. But who is better fitted for the task of educating the public about computers than the computer experts?

It is easy enough to show that the vast majority of errors for which the public blame "the computer" are really due to familiar human failings. But whose job is it to analyse the tasks to be done by a computer, plan the systems and write the programs which are intended to perform the tasks properly? Not that of the general public.

It is easy enough to pontificate about the number of firms which have installed computers they did not really need, or have made inadequate use of their computers, or have unhappily replaced effective but slow business systems with fast but badly-designed EDP systems. Who sold the computers to the firms, supposedly advised them regarding their application, and drew fat salaries while planning their wondrous new system?

"Sorry, we can't do that any more; our accounting / payroll / invoicing system has been computerised." How many times have we all heard this statement, or one like it? Even if in some instances it is used to hide the real reason for providing less service, it suggests that in far too many cases the requirements of a system have been watered down to match the inadequacies of its designers.

Let's face it, the initial phase in the incorporation of computers into our society has not been a shining success. And the unpalatable fact of the matter is that it is the computer experts who are largely responsible for this situation, not the so-called ignorant masses. The time is more than ripe for those in the computer industry to justify their much-vaunted professional status by taking a long, cold look at their track record to date.

Surely the aim is to design computer systems which perform tasks useful to society, not to bluff society into changing its goals to suit computers.

— Jamieson Rowe

ON SALE THE FIRST MONDAY OF EACH MONTH

Printed and published by Sungravure Pty Ltd, of Jones Street, Broadway, at Morley Avenue, Rosebery Sydney.

*Recommended and maximum price only

Editorial Office
12th Floor, 235-243 Jones Street, Broadway, Sydney, 2007 Phone 2 0944. Postal Address: Box 2728, GPO, Sydney 2001.

Advertising Offices
Sydney — 8th Floor, 235-243 Jones Street, Broadway, Sydney, 2007. Phone 2 0944.
Sydney representatives:
Bill Summons, Rob Henry.
Melbourne, — 374 Little Collins Street, Melbourne, 3000. Phone 67 7021.
Melbourne representative: Jeffrey Byrne.
Adelaide — Charles F. Brown & Associates Ltd, 429 Pulteney Street, Adelaide, 5000 Phone 23 1657.
Adelaide representative: Tom Duffy.
Perth — 454 Murray Street, Perth, 6000. Phone 21 8217.
Perth representative: Jack Hansen.

Representation
Melbourne — Sungravure Pty Ltd, 392 Little Collins Street. Phone 67 7021.
Brisbane — Sungravure Pty Ltd, 78 Elizabeth Street. Phone 21 6690.
Adelaide — Sungravure Pty Ltd, 104 Currie Street. Phone 51 3502.
Perth — Sungravure Pty Ltd, 454 Murray Street. Phone 21 8217.
Newcastle, NSW — Associated Newspapers Ltd, 22 Bolton Street, Phone 2 3696.
London — John Fairfax and Sons (Aust) Ltd, Reuter Building, 85 Fleet Street.
New York — "The Sydney Morning Herald" Ltd, 1501 Broadway, New York NY 10036.

Subscriptions
Rates and order form given on page 128.

Circulation Office
9th Floor, 235-243 Jones Street, Broadway, Sydney, 2007. Phone 2 0944.

Distribution
Distributed in NSW by Sungravure Pty Ltd, Jones Street, Broadway, Sydney; in Victoria by Sungravure Pty Ltd, 392 Little Collins Street, Melbourne; in South Australia by Sungravure Pty Ltd, 104 Currie Street, Adelaide; in Western Australia by Sungravure Pty Ltd, 454 Murray Street, Perth; in Queensland by Gordon and Gotch (A'asia) Ltd; in Tasmania by Davies Bros Ltd, Macquarie St, Hobart; in New Zealand by Gordon and Gotch (NZ) Ltd, Adelaide Rd, Wellington.

KITS

AMPLIFIERS — PREAMPLIFIERS — TUNERS — CONTROL UNITS
GUITAR UNITS — INSTRUMENTS — INVERTERS — CONVERTERS
RECEIVERS — TRANSMITTERS — REGULATED POWER SUPPLY
TRANSISTOR AND VALVE TYPES.

KITS

1970-COMMUNICATIONS RECEIVER -240

SOLID STATE

FULL KIT OR INDIVIDUAL PARTS ONLY

MAJOR STOCKISTS OF ALL GENERAL RADIO & ELECTRONIC COMPONENT PARTS — YOU NAME IT — WE WILL QUOTE

VALVES — TRANSISTORS — ZENER & POWER DIODES — SEMI-CONDUCTORS — DIACS — TRIACS — S.C.R.'S. — I/C'S. SPEAKERS — MICROPHONES — COILS — IFT'S. TRANSFORMERS — INST CASES — METALWORK. PLAYERS & CHANGERS — METERS — RELAYS — CONDENSERS — RESISTORS — BEZELS — STYLII — CARTRIDGES — RECORDING TAPE — PROBES — INSTRUMENTS — POTENTIOMETERS — CRYSTALS — FERRITE BEADS — CORES — BALUNS — TERMINALS — CO-AXIAL PLUGS & SOCKETS — MULTI CONNECTORS — PRINTED CIRCUIT BOARDS — COPPER WINDING WIRE — ETC. — ETC. — SEND FOR PRICES SHEETS — POST 20c.

POPULAR KITS - TOP QUALITY - LOWEST PRICES

INSTRUMENTS
C.R.O.
1. 5in wide range.
2. 1963. 3in cal.
3. Audio.
4. 1966. 3in.
5. 1968—Audio.
6. Electronic SW.
7. W band Preamp.

MULTIMETERS and V.T.V.M.'s
8. 20K ohm Volt protected M/M.
9. Probe for above.
10. Protected D.C. M/M.
11. Meterless V/meter.
12. A.C. Millivoltmeter
13. A.C. Solid State Millivoltmeter.
14. Solid State A.F. Millivoltmeter.
15. Noise Distortion Millivoltmeter.
16. Standard V.T.V.M.
17. 1966 — V.T.C.M.
18. 1968 — V.T.V.M.

BRIDGES
19. Standard R/C.
20. 1966—R C.
21. 1968 R C and Signal Injector.

TV INST.'s
22. Sweep and marker Generator.
23. Dual sweep Gen.
24. Silicon diode. sweep Gen.
25. Silicon diode noise Gen.
26. Pattern Gen.
27. Trans. pattern Gen.
28. Wild range pulse Gen.

AUDIO INST.'s
29. 1960 Audio Osc.
30. 1962 High perf. audio Gen.
31. Crystal locked std.
32. Electronic tuning standard.
33. 1965. Solid State audio osc.
34. Direct reading A.F. meter.
35. Sq. wave Gen.
36. 1967 Transistor audio Gen.
37. Additive frequency meter.
38. A.F. tone burst Gen.
38A. 1968. Solid state A.F. Generator.

R.F. INST.'s
39. 6-band service oscillator.
39A. Trans. wave meter.
40. "Q" meter.
40A. Crystal Calibrator —Solid state.
40B. Digital freq. meter
40C. 1969. Dip Osc.—Solid state.
41. G.D.O. wide range.
42. G.D.O. adaptor.
43. Trans. service osc.
44. Simple signal injector.
45. Transistorised signal tracer.
46. Transistorised osc.
47. Basic test osc.
48. Transistor test
48A. IF. Align Osc.

MISCELLANEOUS INST., ETC., KITS
49. 1960. Trans. Tester.
50. 1968 Transistor test set.
51. Valve and Transistor tester.
52. Electronic Stethoscope.
53. Moisture alarm.
54. Electronic Pistol range.
55. Transistor Geiger Counter.
56. Light beam alarm.
57. Burglar alarm.
58. Flasher unit.
59. Transistor alarm.
60. Electronic switch.
61. Photo Timer.
62. Direct reading impedance meter.
63. Electronic anemometer.
64. S.W.R. Indicator.
65. Simple proximity alarm unit.
66. Metal Locator.
67. Electronic metronome
68. Bongo Drums.
68A. Keyless organ.
68B. Theremin.
68C. Laser unit.
68D. Color organ.
68E. Stereo Headphone Adaptor.

BATTERY CHARGERS
69. Universal unit.
70. 1 amp unit.

REGULATED POWER SUPPLIES
71. Transistor, 9v.
72. Transistor, fully protected supply.
73. 1966 H.T. unit.
74. 1968 lab. type. 0-30v supply.
74A. Simple pwr. supply

VOLTAGE-CURRENT CONTROL UNITS
75. Vari-watt unit.
76. Vari-tach. motor speed control.
77. 2KW auto-light dimmer.
78. 4KW auto. light dimmer.
79. Model train control unit.
79A. Vari Light Dimmer.
80. Model train control unit with simulated inertia.
81. Above-hi-power.
82. No. 81 with simulated inertia.

TACHOMETER UNITS
83. 6 or 12v Std.
84. 6 or 12v Mullard.
85. 6 or 12v with dwell angle.
86. Tachometer and dwell angle unit for service stations.

TRANSISTOR IGNITION
87. Ro-Fo. 6 or 12v.
88. Hi-Fire 6 or 12v. (transformer).
88A. C.D.I. unit.
88B. Electronic Ignition.

POWER CONVERTERS
89. D.C.-D.C. 60w.
90. D.C.-D.C. 40w.
91. D.C.-D.C. 40w. 12v — Input
92. D.C.-D.C. 70w. 12v — Input.
93. D.C.-D.C. 100w 12v — Input.
94. D.C.-D.C. 140w. 24v — Input.
95. D.C.-D.C. 225w 24v — Input Q.

HIGH-FIDELITY AMPLIFIERS MONO UNITS
96. Hi Fi 3.
97. Mullard 3.3.
98. Mullard 5-10.
99. Mullard 5-10. transistor.
100. Transistor 20w.
101. Transistor 60w.

STEREO UNITS
102. Mullard 2-2.
103. Mullard (v) 3-3.
104. Mullard (t) 5-5.
105. Mullard (t) 5-5.
106. Mullard (v) 10-10.
107. Mullard (t) 10-10.
108. Philips Twin 10.
111. Hi-Fi 60 Plus 60. P/M 128.
112. Playmaster 2-2.
113. Playmaster 3 plus 3.
114. Playmaster unit 3.
115. Playmaster unit 4.
116. Playmaster 10 plus 10
117. Playmaster 101.
118. Playmaster (t) 105.
119. Playmaster (t) 113.
120. Playmaster (t) 115.
121. Playmaster (v) 118.

P.A. UNITS
122. 10 watt std.
122A. Mullard 20w Solid state.
122B. Mullard 40w. Solid state.
123. 25 watt std.
124. 35 watt std.
125. 30 watt (t).
126. 100 watt std.
127. Stereo P.A.

GUITAR UNITS
128. 10 watt std.
129. 25 watt std.
130. 35 watt std.
131. 50 watt std.
132. 70 watt (t).
133. Playmaster 102.
134. Playmaster 103.
135. Playmaster 40w. 116.
136. Playmaster 60w 117.
137. Guitar fuzz box.
138. Guitar Waa-Waa.
139. Reverb unit.
140. Guitar preamp.
140A. Guitar 50w. Solid State P/M 125.

STEREOGRAMS
141. Playmaster 105.
142. Playmaster 106.
143. Playmaster 107.
143A. Playmaster 124.

CONTROL UNITS
144. Playmaster No. 9.
145. Playmaster No. 10.
146. Playmaster No. 104.
147. Playmaster No. 112.
148. Playmaster No. 120.
149. Mullard 2v.
150. Mullard 3v.
151 Philips Miniwatt.
152. P/M 127.

PREAMP UNITS
153. Transistor — Mono.
154. Transistor — Stereo.
155. Transistor — Silicon.. mono.
156. Transistor F.E.T. mono.157.
157. Transistor dyn. mic. mono.
158. Above-Stereo.
159. Playmaster 115 F.E.T. Stereo.
160. Playmaster 115 mag.
161. Sound projector.

MIXER UNITS
162. Trans. 4 ch. (1966).
163. Trans — 4 ch. (1967).
164. Valve — 4 ch.

TUNER UNITS
165. Playmaster u/style.
166. Playmaster No. 11.
167. Playmaster No. 114.
168. Playmaster No. 122.
169. Playmaster No. 123.
170. Philips Miniwatt.
180. Trans — Long range.

TAPE UNITS
181. Trans. Preamp.
182. Playmaster 110 (M).
182. Playmaster 110 (S).
183. Power Unit 110.
184. Adaptor 110.
185. Playmaster 119 Adaptor.
186. Transistor V.O.X.
187. Tape Actuated relay.
188. Mullard Trans Tape Amp.

RECEIVERS
189. Fremodyne 4, 1970.
190. Fremodyne 4 R.F.Soct. only.
191. Synchrodyne.
192. Communications RX.
193. Deltahet RX.
194. 3 Band Double Change S/het RX.
195. Explorer VHF Transistor RX.
196. Interceptor 5 Semi-Comm. RX.
197. 1967 All-Wave 2.
198. 1967 All-Wave 3.
199. 1967 All-Wave 5.
200. 1967 All-Wave 6.
201. 1967 All-Wave 7.
202. Transporta 7.
203. Transistor 8 3 Band.
204. 3 Band 2V RX.
205. 3 Band 3V RX.
206. All Wave 1970 I/C 2.
207. Versatile Mantel Set
208. All-Wave Transistor 3
209. A.B.C.
210. 1968 F.E.T.
210A. I/C TRF RX.
210B. R.F. Preamp.
210C. "Q" Multiplier.
210D. 1970 Communciations. Solid state

TRANSMITTERS
211. 144 MHz 50W. Linear Final.
212. 144 MHz 20W.
213. 144 MHz 20W.
214. 144 MHz 18W.
215. 144 MHz S.S.B.
216 3 Band A.M.
217 Basic 3 Band.
218 5 Band. S.S.B.
219. 1967 S.S.B.

CONVERTERS
220. 50 MHz
221. 144 MHz, 1970.
222. 50 and 144 MHz Crystal Locked.
223. 1965 S/W.
224. 1965 S/W 2 Band.
225. 1966 3 Band.
226. Basic S/W.

V.F.O. UNITS
227. Remote Unit.
228. 7, 8 and 9 H.F. and V.H.F.
229. All transistor.

Phone 63-3596

E. D. & E. (SALES) PTY. LTD.

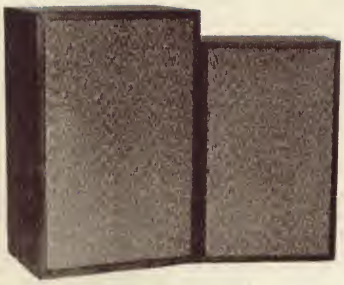
Phone 63-3596

232 FLINDERS LANE, MELBOURNE, VICTORIA. 3000.

INSTROL SPEAKER SYSTEMS

All the systems below are available in kit form. The cabinet kits come in either unpolished Queensland Maple veneer or unpolished teak veneer. All kits are complete, and include speakers, crossover networks (where applicable), cabinet kits, grille cloth and innerbond.

NEW MAGNAVOX 8-30 SYSTEM



Featured in "E.A." Jan. 1971. It handles 30 watts RMS, FEATURES A NEW HIGH PERFORMANCE 8" SPEAKER, TWO 3" TWEETERS, AND IS AVAILABLE IN CABINET 20-7/8" x 12-7/8" x 8-7/8" (1 cu. ft.) or 23-7/8" x 15½" x 10-7/8" (1.6 cu. ft.). Available in teak or maple veneer.

COMPLETE SYSTEM

Kit of Parts	$46.00 (1 cu ft), $58.00 (1.6 cuft)
Built and Tested	$60.00 (1 cu ft), $76.00 (1.6 cu ft)

SEPARATE COMPONENTS

Enclosure kit (1 cu ft)	$19.00 (maple), $19.50 (teak)
Enclosure kit (1.6 cu ft)	$31.50 (maple), $33.00 (teak)
Built Enclosure (1 cu ft)	$32.00 (walnut), $33.50 (teak)
Built Enclosure (1.6 cu ft)	$48.50 (walnut), $51.00 (teak)

ECONOMY BASS REFLEX SYSTEM

"E.A." design, Nov. 1970, consists of a Rola C8MX speaker. In cabinet 20" x 11" x 9". Ideal for low wattage.

COMPLETE SYSTEM

Kit of Parts (teak or maple)	$26.00
Built and Tested (teak or walnut)	$39.00

SEPARATE COMPONENTS

C8MX speaker only	$9.05
Enclosure kit	$16.50 (maple), $17.00 (teak)
Built Enclosure	$29.00 (maple), $30.50 (teak)

WHARFEDALE SPEAKER SYSTEM KITS

The Wharfedale Super Linton, Melton and Dovedale 111 are now available as build-yourself kits, featuring INSTROL quality cabinet kits in choice of maple or teak veneer.

The Super Linton kit employs an 8" and 3" speaker, frequency response 40-17,000Hz, cabinet 21" x 11½" x 9½". 15 watts RMS. The Melton kit employs a 12" bass and a tweeter, cabinet 22¾" x 13" x 10", 25 watts RMS.

The Dovedale III kit employs a 12" bass, 5" mid-range and 1" tweeter. Cabinet 28" x 15½" x 10". 35 watts RMS.

COMPLETE SYSTEM

Super Linton kit (Unit 3)	$49.00
Melton kit (Unit 4)	$93.00
Dovedale III kit (Unit 5)	$127.00

SEPARATE COMPONENTS

Unit 3 encl. kit	$17.00 (maple), $19.00 (teak)
Unit 4 encl. kit	$25.50 (maple), $27.00 (teak)
Unit 5 encl. kit	$34.00 (maple), $35.50 (teak)

KEF SPEAKER SYSTEMS

CONCERTO — The KEF Concerto contains B139 bass unit, B110 midrange and T27 tweeter in teak cabinet 29" x 17" x 12". Frequency range 30-30,000Hz. Power handling capacity 25 watts.

CONCORD — The KEF Concord contains B139 bass unit and T15 tweeter in attractive teak cabinet. Frequency range 30-20,000 Hz. Power handling capacity 25 watts.

CHORALE — The KEF Chorale contains B200 bass unit and T27 tweeter in teak cabinet 18½" x 11" x 8-5/8". Frequency range 35-30,000Hz. Power handling capacity 25 watts.

COMPLETE SYSTEMS

Concerto System	$220.00
Concerto speaker & enclosure kit	$165.00
Concord System	$149.00
Concond speaker & enclosure	$113.00
Chorale System	$120.00
Chorale speaker & enclosure kit	$ 90.00

SEPARATE COMPONENTS

Concerto speakers & crossover	$140.00
Concord speaker & crossover	$ 89.00
Chorale speakers & crossovers	$ 75.00
Concerto enclosure kit only	$ 45.00
Concord enclosure lit only	$ 36.00
Chorale enclosure kit only	$ 26.00

INSTROL HI-FI & ELECTRONICS CENTRE

91A YORK ST., (between King & Market Sts.), SYDNEY, N.S.W. 2000. Phone 29 4258

Please send me the following speaker systems and/or turntable systems and/or perspex covers. These will be sent by road transport or passenger rail, freight payable on receipt of goods

.... at $ ....

.... at $ ....

.... at $ ....

Inclose my money order/cheque for $............................

NAME..

ADDRESS..

....P.C. ....

E205

25 Years of Inventions for

The old adage about "the blind leading the blind" acquires new meaning in this story. It concerns a Canadian electronics engineer, blind himself since early childhood, who has designed and developed numerous aids for blind persons to assist them in daily life and work.

It's been 25 years since James Swail — just graduated from McGill University's Faculty of Science — joined the National Research Council of Canada. His objective: to make a personal contribution in the struggle of blind people to achieve an independent way of life in a sighted world.

In the two decades since Jim Swail went on staff with the Instrument Section of NRC's Radio and Electrical Engineering Division, he has produced close to 100 instruments and devices for increasing the mobility and job skills of the sightless.

In the process he has gone a long way to demonstrate, by personal example, how to live and work creatively despite such a handicap. For Jim Swail has been blind since the age of four. His university days were hard ones. He took his notes in Braille and relied on fellow students to read to him. The tape recorder and many other electronic devices now in use by the blind were non-existent in the early 1940s.

During his first five years with NRC Mr. Swail developed special electronic equipment to help him conduct his own research. There followed a steady and continuing stream of mechanical and electronic devices. Some, like the Braille thermometer for a blind man to measure the melting point of type metal in a print shop, and special meters which enabled a blind radio announcer to be licensed to monitor all the functions of a broadcast station, were designed to help one specific person surmount one specific obstacle. Others have wider application. The most recent is an ultrasonic obstacle detector for the blind.

Reprinted from "Science Dimension" of Ottawa, Canada.

The ultrasonic detector is Jim Swail's approach to the blind man's problem of how to navigate in restricted areas without the traditional long white cane or the seeing eye dog. There are certain situations where both the cane and the dog become, in Jim's words, "socially unacceptable." Indoors, in a crowded house party setting, for example, the cane tends to trip people and becomes a bit of a nuisance to have around. The same applies to the dog. A similar situation occurs when a blind man navigates between rows of tables in a restaurant. He lives with the fear that his cane, in searching out obstacles, will inadvertently slide under one of the tables and touch another person — to everyone's intense embarrassment.

For such situations, but more generally when a blind person is not called upon to move quickly nor perform actions calling for much care and attention, (i.e. scanning an office or corridor for newly-placed or disarranged articles such as chairs, tables, wastebaskets, etc.), the handheld ultrasonic detector is expected to prove highly useful.

The device, essentially, is a simple radar unit using inexpensive transducers similar to those used in the television industry for remote control of television channel switching. It is packaged in a pocket-sized plastic carrying case with integral handle.

Power for the unit is derived from built-in rechargeable batteries. The device generates 40KHz, or 70KHz, transmitted as two-millisecond pulses in a narrow beam at a pulse repetition rate of 10 per second. The receiver unit is turned on immediately after the termination of the pulse. A range switch mounted on the handle selects the length of time the receiver remains on after each pulse.

The ranges have been set at 4ft, 7ft and 15ft and the receiver unit will respond to targets within the selected range. If a reflected pulse is received within the above chosen ranges, a monostable circuit is fired. This in turn drives a solenoid-operated tactile stimulator, a rod which vibrates through a hole in the unit's handle and against the forefinger of the operator. The distance to a target can be estimated by altering the range control until the indication ceases. Target direction is determined by scanning.

The prototype device was field tested for signal interference levels at an Ottawa construction site. It was found that the ultrasonic energy generated by construction equipment such as air-brakes had no jamming effect on the unit's signal.

"We gave it a pretty stiff test, and it performed beautifully, so we are confident it can operate anywhere safely," Mr. Swail says.

The device has its limitations. The beam width (eight degrees) and the pulse rate of 10 per second means that scanning cannot proceed as swiftly as would be desired. Too fast a scan and the object is missed. Certain objects such as corners around doors give disproportionately high ultrasonic reflection, confusing the operator as to target locations. Consequently Mr. Swail

A blind programmer can quickly scan a punched card with this special reader.

This machinist's level emits a high-pitched tone unless it is exactly level.

the Blind

expects operators will have to undergo a short period of training if a high degree of effectiveness is desired.

Other Swail-engineered instruments include:

— A photoelectric sensor for detecting light sources. One pencil-sized version allows blind personnel to operate telephone switchboards. When a line comes into use a light goes on and the operator can locate the line by scanning with the sensor. Another use includes detecting the presence of print on a page.

— A manually operated reader for IBM punched cards to assist blind persons working as computer operators and in related fields. A carriage is moved across the card and pins are raised when a hole is encountered. Brailled markings indicate the location of the hole.

— Various electronic thermometers equipped with tactile and auditory readouts are used by blind technicians working in commercial photographic darkrooms.

— Several instruments designed to assist the Canadian National Institute for the Blind in its vocational training program.

— The Swail Dot Inverter for production of Braille drawings by hand. In producing a Braille drawing, a pointed instrument is used to produce characters by punching holes through paper. The raised dots forming the characters come out on the underside of the paper meaning that Braille must be produced in reverse. The Swail inverter raises the dots on the upper side, eliminating the reversal process.

— An auditory beacon which emits a beep every 10 seconds, enabling a blind person to place it next to an object he wishes to leave and then later locate.

— A four-section collapsible white cane for the blind. Rigid in use, four feet in length, it can be carried in a blind person's pocket.

A light detector enables the blind operator to locate a flashing light indicating an incoming telephone call.

This tiny electronic "bleeper" makes it easier for the blind to leave and later relocate needed items.

James Swail (right) demonstrates his ultrasonic obstacle detector in an office corridor. A close-up of the detector is shown at the left.

Home Video Replay & Colour TV: Rendezvous by March 1975?

At present most of the colour TV planning by the Australian consumer electronics industry is directed towards the commencement of broadcasting in March, 1975. However it is entirely possible that by this time another important dimension may be added to the colour TV picture: the concept of low cost home video playback.

A colour home video replay system being marketed by Hitachi Ltd. This system uses EVR film cartridges.

Not long ago on the French Riviera, more than a thousand hard-headed businessmen from countries all over the world were chasing a dream. The dream that Americans, Britons, Japanese, Dutchmen, Germans, Frenchmen and others were pursuing in Cannes was a very tantalising one for the modern consumer electronics industry: home video players and recorders.

Already introduced in industrial, educational and other institutional markets, video recordings — in the form of cartridges, cassettes and discs — have long been on the horizon as a home entertainment medium but have not quite made it yet.

However those attending the Second International Conference on Video Cassettes, called VIDCA, learned that the long-promised "revolution" of personal television geared to individual tastes may soon be here, according to video trade analyst Leonard Sloane.

"And somewhere between the blue-sky pontificating of the over-optimistic and the wailing of the prophets of gloom lie the realities of the enormous impact that home video recordings could make in the future to those within the electronics and entertainment industries and without," "The New York Times" expert predicts.

The names of those companies involved in this market range from giants on the "Fortune" 500 list to smaller concerns that are both publicly and non-publicly owned. Their total investments are well in the range of hundreds of millions of dollars and a few of them have been working in this field for more than 10 years.

As with so many other technological innovations, there have been three major bottlenecks to progress for home video recording systems — engineering, economics and compatibility. The first has apparently been cleared by at least some of the hardware and software manufacturers, and the second is within reach in the years immediately ahead. But as yet the third is nowhere in sight.

The potential, however, is vast enough to spur on those who might have been otherwise discouraged by the relatively slow progress so far and the frequent failures to meet target dates for reaching the public.

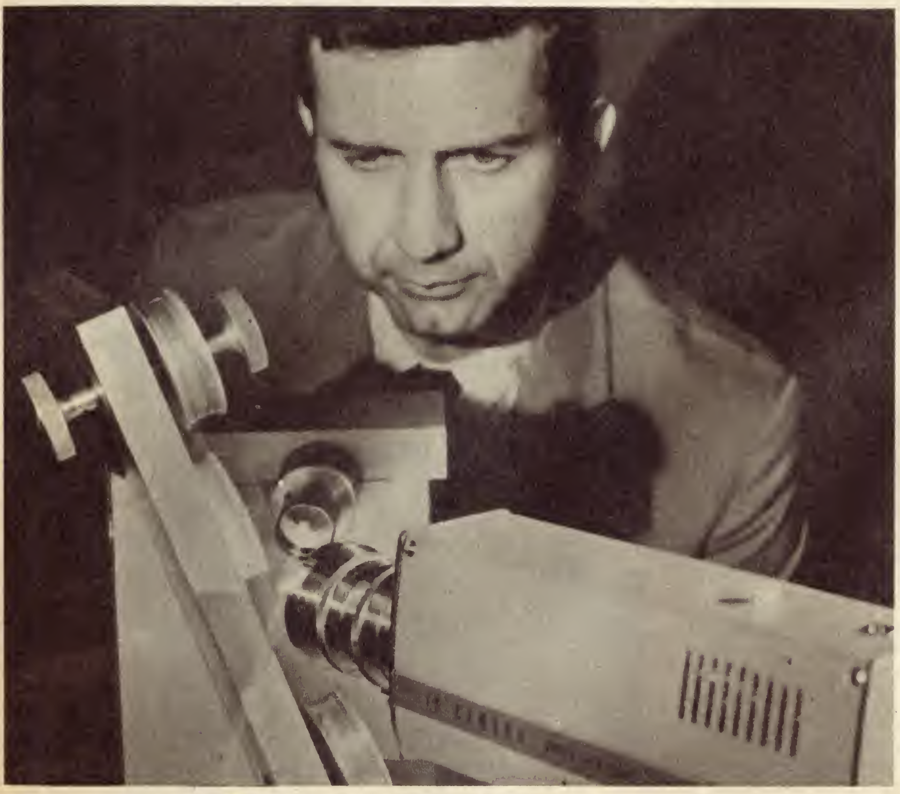
Arthur D. Little, Inc, estimates that the consumer market could reach $200 million within a year, while others envision the worldwide volume for hardware and software each at the level of around $2,000 million by 1980.

Daniel Denham, a division vice-president of the 3M company, says that sales of home video recording machines and equipment have "as high a potential as colour TV."

Last year, 6.1 million colour television sets were sold with a retail value of more than $3,000-million.

Denham's company, of course, has a vested interest in this fledgling market, as do such well-known names as the RCA Corp, Columbia Broadcasting System, Sears Roebuck and Co, Inc, Eastman Kodak Co, EI Du Pont de Nemours and Co, Columbia Pictures Industries, Inc, and Motorola Systems, Inc. Then there are also Cartridge Television, Inc and the Ampex Corp, and, from abroad, AEG, Telefunken, British Decca, and NV Philips — not to mention Japanese companies like Sony, Matsushita, Toshiba, Hitachi and Shibaden.

Despite all of these names, not a single



An early prototype of the RCA holographic tape system. Announced in early 1970, it uses low cost embossed plastic tapes and a laser replay technique.

video recording unit has been sold yet for the home — unless someone bought an expensive commercial device as a plaything or an executive of a corporation in the industry purchased one wholesale. So the market is starting from scratch and can go nowhere but up.

"The colour video cassette recorder is a new consumer concept that has yet to prove its viability as a consumer product," according to Gerald Citron, manager of the consumer electronics department of the North American Philips Corp.

"In order to become a mass market item, the device will have to retail for no more than $500 to $600 dollars and ideally should retail for between $250 and $400 dollars."

Right now, though, there is no device in that moderate price range to whet the appetite of American consumers. As far as the manufacturers are concerned, notes one security analyst who follows the field closely, "it's still a big poker game — with everyone sitting there waiting for something to happen."

There are basically four different technologies presently striving for acceptance in home video recordings. These are magnetic tape, photographic film, discs and holographic tape. Photographic film is further subdivided into normal film taken using a camera, and "EVR" film made using an electron-beam recording system.

Just as manufacturers once battled for dominance in determining the speed of long-playing records and later the system for colour television, producers of hardware are firing their marketing and promotional guns full blast in an effort to win this billion-

A cassette for the Sony "U-Matic" colour videotape system, recently announced.

dollar war. Until one of these systems forges into the lead, suppliers of software and programming are generally hedging their bets and remaining neutral.

Dr Peter Goldmark, a pioneer in video recordings at CBS and now establishing an organisation at Warner Communications, Inc, says that "asking who can win this battle is like asking who won the San Francisco earthquake."

As far as Australia is concerned, the battle may well be decided before colour TV broadcasting begins in 1975. Apart from creating a new market for home video playback equipment and programs, the development may also provide a worthwhile impetus to the colour TV receiver market. Most of the systems under development are designed to feed into normal receivers, and most are orientated towards colour playback. It is likely that few users will be content to play back their colour cassettes through their existing monochrome receivers.

(Adapted from "Australian Financial Review", by permission.)

LOCAL SEMICONDUCTOR BREAKTHROUGH:

Fairchild scores a win in battle of the big chips

Locally made silicon power transistors like the popular "workhorse" 2N3055 are now available in commercial quantities, as a result of new development at Fairchild's plant in Croydon, Victoria.

by JAMIESON ROWE

Despite its ubiquity in solid state hi-fi amplifiers, power supplies and switching circuits, the silicon bipolar power transistor is not easy to make on a full-scale commercial basis. Like other semiconductor manufacturers, Fairchild Australia has had its share of troubles in producing these devices. But unlike others the company has now announced that they have finally mastered the technology of "big chips", a development which has enabled them to produce the first commercial quantities of locally-made power devices.

Progress has not been easy. As Manufacturing Manager Bernie O'Shannassy says with some feeling, "The so-called 'humble workhorse' 2N3055 may be easy enough to make on a one-off basis in the lab, but to make this type of device in commercial quantities is damned hard. It's taken us just on four years of trials and tribulations in order to iron out the problems, but it's finally paid off."

Some of the problems which had to be solved centred around design of the actual device chip or die. At first Fairchild tried using a scaled-up version of their highly successful small signal planar construction, developed by physicist Jean Hoerni in 1960 at the Mountain View plant. However the planar approach produced a relatively expensive power device, and one whose characteristics were not entirely suitable for many applications. Then they tried a multiple emitter construction, like that used for RF power devices, with resistive nichrome emitter bonding wires to ensure current sharing. The story was still much the same.

A significant step forward came with the change to their "bi-mesar" chip. This is Fairchild's version of the epitaxial collector — epitaxial base power construction. With grown base and collector regions, the bi-mesar chip can be designed for very predictable high current and high voltage performance. And because it involves only one critical masked diffusion process, it lowers the cost of producing devices on the basic silicon wafer. Fewer production steps and higher yields help to at least partly compensate for the reduced number of big chips per wafer, and the relatively high cost of power packages.

Close-up of a 2N3054 chip bonded to a TO-66 header. This chip is .070in x .90in; the 2N3055 chip is even larger — 0.14in x 0.14in.

Fairchild's Manufacturing Manager Bernie O'Shannassy inspects TO-66 power devices as they emerge from the die-attach furnace at the Croydon plant.

But finding the right type of big chip was only part of the story. Putting the chip into its package to produce a reliable high performance end product is not nearly as easy as it might seem. The main problem is to achieve a proper bond between the die itself and the package header. The bond must be secure mechanically, while not subjecting the die to stress. It must also present a low thermal impedance, yet at the same time have just the right thermal expansion characteristics.

After much investigation Fairchild finally adopted a special reflow solder bonding technique which uses a four-zone hydrogen furnace. The composition of the solder is part of the secret, another being the temperature profile of the furnace.

Using these techniques the Croydon plant has been producing commercial quantities of power products for some months, and a thorough testing program has shown that they are consistently meeting all specs.

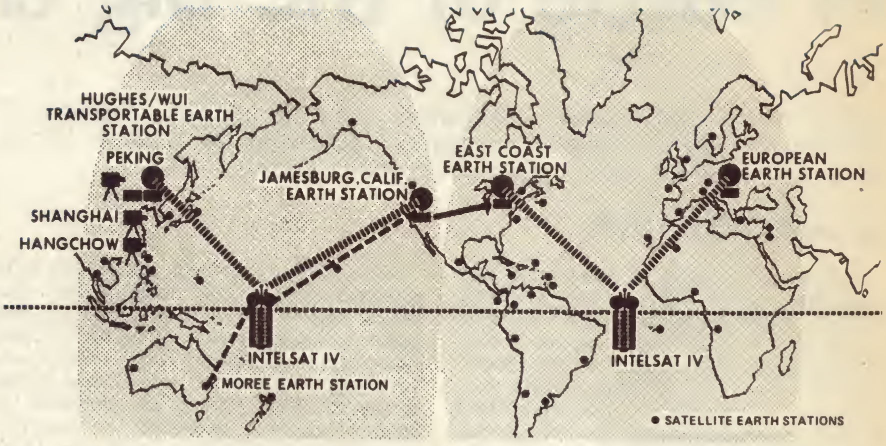
The fourteen power products currently being made include TO-3 devices such as the popular 2N3055, TO-66 types such as the 2N3054, and smaller TO-5 devices. Both NPN and PNP types are being made, and Fairchild say their technology makes it equally easy to produce either polarity.

Being able to produce silicon power products of this type in Australia on a full-scale commercial basis is a big achievement, and Fairchild is justifiably proud. Of course, having demonstrated the capability of local technology, they can now expect tariff protection. But Marketing Manager Trevor Andrews stresses that this was not their goal: "It would be quite wrong to think that we undertook this development simply in order to obtain tariff protection. It was a purely commercial enterprise. We believe that the market in Australia for silicon power devices will justify our investment in developing the technology."

How we got live pictures from Peking

Those live TV pictures we watched of President Nixon's China visit should be forgiven for looking a bit tired at times. They had travelled from a mobile earth station in Peking to a satellite 22,300 miles above the Pacific, then down to an earth station in California where they were retransmitted back to the same satellite for relay to Australia. From OTC's earth station at Moree they were distributed to local TV stations by cable and microwave, then transmitted to your television sets.

Considering the length of the journey and the number of relay stations the signals went through, the pictures appeared in fairly good condition.



An indication of the dependability of modern electronic equipment is the fact that a month before the visit, neither the Peking earth station nor the satellite which relayed the pictures had been put in place.

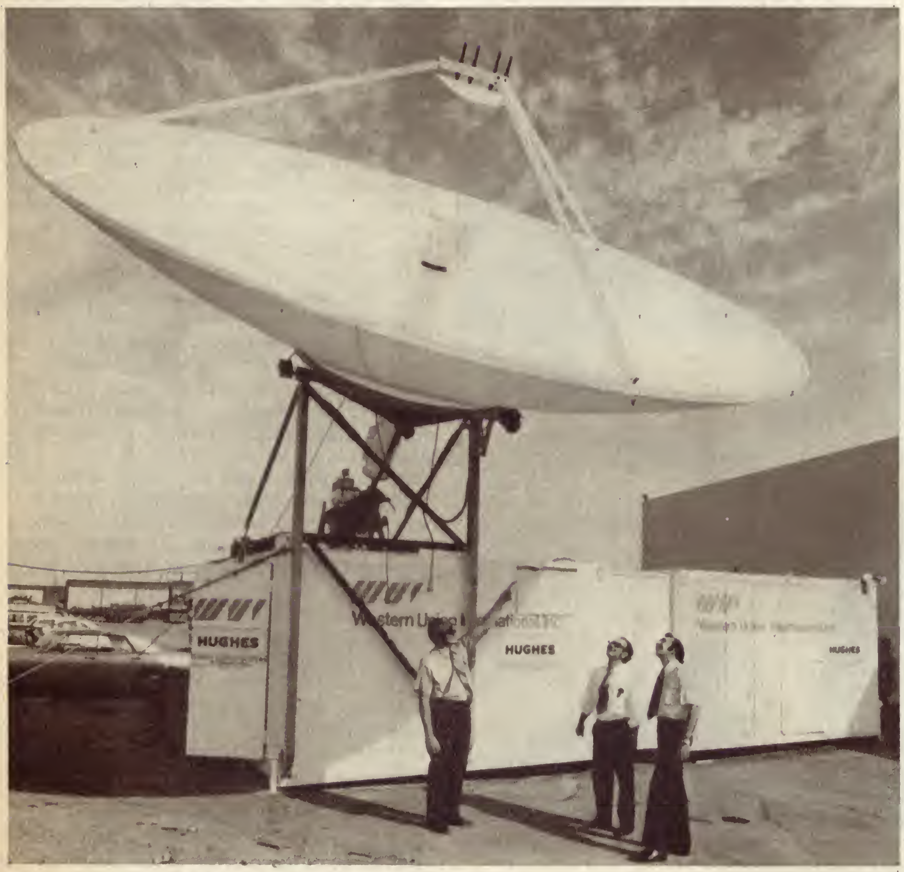
The earth station used in Peking was a mobile system built by the Hughes Aircraft Company for Western Union International. The 50,000 pound station was flown to the People's Republic of China aboard a Super Hercules commercial cargo aircraft which arrived in Peking February 2, just three weeks before the Presidential party. The mobile station, which consists of two 14ft trailers full of electronics and a 24ft diameter dish antenna, was set up in 48 hours and began testing with the new Intelsat IV satellite. The satellite had been launched on January 31.

In addition to its television capacity of one colour channel and nine voice commentaries, the station has 60 two-way telephone channels for other voice, telephoto and teletype reports. The $A1.2 million station operated 24 hours a day during Mr Nixon's stay in China.

The first version of the ground station was developed by Hughes in 1968 and air-shipped to Bogota, Colombia, to transmit color-TV coverage of Pope Paul's visit. Later the same year it was air-lifted to a coastal site near San Jose, California, from where it relayed TV pictures of the Mexico City Olympics to the Far East. Last October the same roving quickie-TV station used in Peking was based in Iran to serve as a WUI communications link during the Shah's celebrations of the 2,500th anniversary of the founding of the Persian Empire.

After its launch at the end of January, Intelsat IV was tested by OTC's Carnarvon tracking station and a similar station in Paumala, Hawaii. Partly owned by OTC through their membership in Intelsat, the new satellite was the key to getting the Peking pictures live in Australia because the satellite formerly used, Intelsat III, had only one television channel. Intelsat IV can handle up to 12 TV channels simultaneously.

If Intelsat IV had not been in orbit, the single TV channel on Intelsat III would have



QUICKIE TV STATION. Engineers at Hughes Aircraft Co in California examine the mobile Earth station their company built for Western Union International. The station was on the air with one colour TV channel and 60 voice channels only 48 hours after its arrival at Peking airport.

been used for the China-US link and a direct rebroadcast to Australia would not have been possible.

One of the pre-visit agreements made between the Chinese and the Americans was that all communications must go directly to the United States. Otherwise Australian TV viewers could have seen their live pictures directly from China via the satellite.

The colour picture of Mrs Nixon which appeared on the cover of the March 13 issue of the magazine "Woman's Day" had an even longer route to travel. It was transmitted in three colour separations from Peking to California, then by land-line to New York where it went into the United Press International picturegramming service which links New York with London, Sydney and Hong Kong. Each colour separation took 15 minutes to arrive on the picturegram machine.

It was the first time a colour picture had been transmitted from China.

Better communication links with China in future are highly probable, as the Chinese have bought a $A1.84-million earth station which RCA built in Shanghai prior to the American President's visit. The Peking installation, however, has been dismantled and returned to the United States.

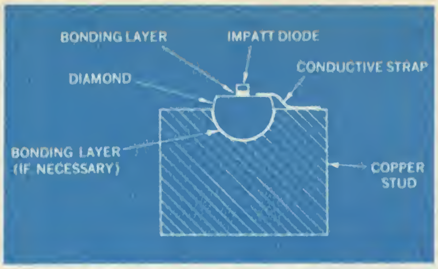
Intelsat IV will be used for routine TV and message communications between Australia and the US, Japan, New Zealand and Hong Kong through OTC's earth stations at Moree and Carnarvon.

— Dick Levine.

New diamond heat sinks developed

De Beers diamond research laboratory in Johannesburg has developed a new method of making diamond heat sinks for microminiature devices. In the new process, high thermal conductivity diamonds from 1 to 2.5mm are rounded in bulk and then accurately graded for size.

Previously, diamond heat sinks have been made by slicing stones into slabs, polishing them, then slicing them into squares.



With the new method several hundred diamonds can be processed at the same time prior to metallising and bonding as shown in the illustration. In the next step the diamonds are either hot-pressed into copper blocks or the blocks are drilled to accommodate the diamonds.

The assembly has such high heat dissipation and electrical insulation that several devices can be mounted on a single heat sink. De Beers' new technique shows particular promise for use with IMPATT diodes, not only because of high heat dissipation but because accurate size grading of the diamonds is essential when heat sinks are used in microwave cavities.

Facsimile system transmits on voice line

A facsimile system that reduces the cost of transmitting newspaper and magazine pages to distant printing plants by as much as 80 per cent has been introduced by Litton Industries.

By compressing words and pictures on a printed page into digital pulse groups, the new system allows high-speed transmission of reproduction quality facsimile over low-cost telephone lines.

This new application of digital technology will permit publishers to send facsimiles over privately leased phone lines at less cost than similar systems now available. Currently, full-page newspaper and magazine facsimiles are transmitted over expensive wide-band communication channels in order to produce facsimile copies of a quality suitable for use in the printing process.

In conventional facsimile, a newspaper page is scanned, just as a person reads it — left to right, top to bottom. The facsimile scanner picks up individually and sequentially as many as 135 million black print and white space elements for transmission and reproduction at the receiver. This method requires a transmission frequency band of 48kHz, as wide as that needed to carry a block of a dozen voice channels.

Litton's technique, called Data Redundancy Reduction (DRR), transmits digital pulse "instructions" to the receiving machine for recording the black print and white space elements in proper sequence along the line being printed. A group of as few as seven pulses carries the instruction for more than 100 consecutive black or white space elements, reducing the bandwidth to approximately 3kHz.

Key to the development is a proprietary method for closely matching the constant speed of the facsimile machine drum which holds the printed page with the highly variable rate at which black and white elements are picked off and coded for transmission. Smoothing this difference in rates makes possible the use of low cost narrow band transmission lines.

Axle load indicator invented in New Zealand

A New Zealand inventor has developed an electronic axle load indication system which shows loading of any number of axles by an indicator in the cab of heavy transport vehicles. A sealed sensing device with no moving parts is mounted on each axle to be monitored; a selector switch within easy reach of the driver permits him to read loading on any axle individually.

The system, known as ALIS (axle load indicator system), is now commercially available. For more information write ALIS, PO Box 40.172, Upper Hutt, NZ

Flying atomic clock experiment supports Einstein's theory

Time dilatation — the special part of Einstein's relativity theory that predicts more time will pass for stay-at-homes than for fast-moving space travellers returning to earth underwent a new test recently; also tested by the experiment was the interaction of gravity and time, a part of the General Theory.

It was the first known experimental demonstration of these effects using actual time-recording clocks.

The preliminary results seem to support Einstein.

Professor Joseph C. Hafele of Washington University, St Louis, Missouri, and Richard Keating of the U.S. Naval Observatory, Washington, DC, flew a set of four Hewlett-Packard precision atomic clocks around the world. They flew the route once eastward and once westward, measuring how much time the clocks recorded during their trips, relative to the time observed on earth by the ensemble of Hewlett-Packard atomic clocks at the Naval Observatory which are the United States' official timekeeper. The experiment was funded by the Observatory.

A bit older than they should be are Prof. Hafele (left) and R. Keating (right), being greeted by Al Walker of Hewlett-Packard.

Preliminary, uncorrected results for the experiment indicate a slight loss for the eastward trip and a definite gain for the westward trip, as Einstein's theory would predict for paths similarly flown.

To test the theory, the results of the experiment must be compared with the results the theory would predict. To predict the results, two aspects of relativity theory must be considered. One of these treats the interaction of velocity and time, the other the interaction of gravity and time.

The expected results depend on the actual paths, velocities, and altitudes during the flights. For a total flight time of about 38 hours at 650 miles an hour, at an altitutde of 35,000 feet around the equator, the predicted results are a loss for the eastward flight of about 110 nanoseconds relative to the clocks on earth, and a gain of about 300 nanoseconds for the westward flight.

Or, in plainer language, you do age a fraction of a second while in flight, but the amount depends on the direction in which you were travelling.

NEWS HIGHLIGHTS

Lasers make clean-cut hybrid circuits

Three new laser production tools have recently been put on the production line at Motorola Inc. They are being used to trim thick and thin film resistors, active filters and networks in hybrid circuits.

The lasers are computer controlled, with the computer monitoring component values until design parameters are reached, then automatically cycling the laser to the next trim location in the hybrid circuit.

According to Motorola, laser trimming has increased production speed, improved control of resistance changes and resistor size due to the narrow laser beam cut, and improved reliability and stability of hybrids because no abrasives are used to cut the resistor films.

PIP — 60 MINUTES OF TRAINING ON 50 FEET OF FILM. Philips Industries new "programmed individual presentation" (PIP) training system has sound and visual elements of a program contained in separate compact cassettes. The visual component, in a new Super-8mm cassette, lasts as long as the 60 min sound cassette because many pictures are in slow motion and the film is stopped for single frame presentations. Inaudible electronic pulses on the audio cassette tape control the variable-speed projector. PIP is shown in action below.

NOVEL TV ANTENNA TOWER. A new 1080 ft (360m) antenna tower in Yorkshire was made from poured concrete up to the 900ft level. The last 180ft of steel mast was assembled inside the base of the concrete section and hoisted up through the centre. Complete with antennas for Yorkshire TV and BBC-1 and 2, the top section weighed 60 tons as it was lifted up through the tower. The tower became operational less than 18 months after start of construction.

Preparing for 1984

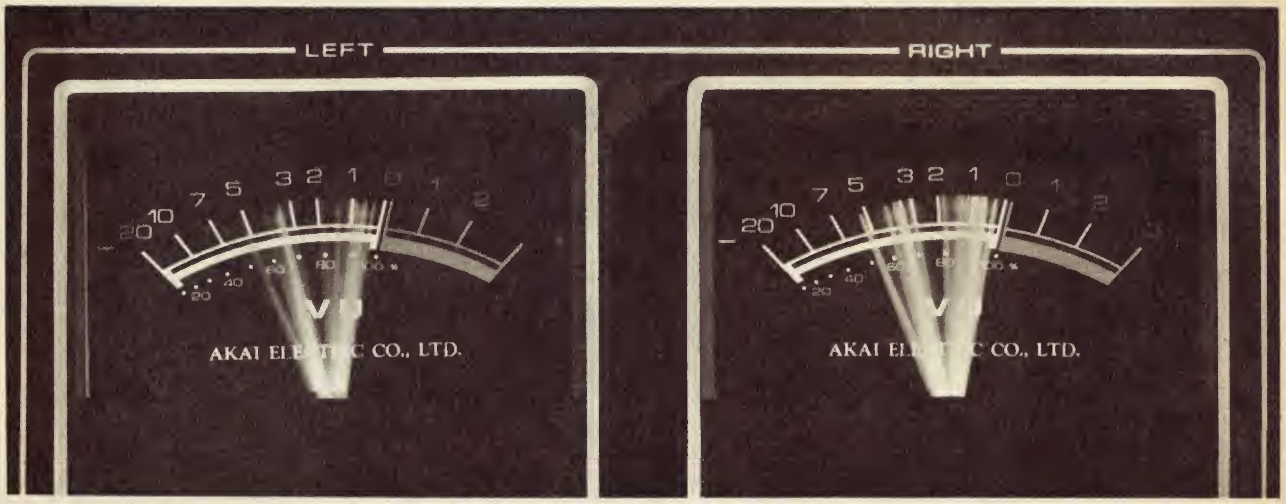
The new town of Milton Keynes in England is being wired for the sound and video services of the future by the British Post Office. A twin cable system is being brought into each house. One cable is a standard telephone pair; the other is a high performance coaxial cable capable of relaying computer data, meter reading signals and video signals in both directions.

A central relay system will receive TV and radio signals from an aerial. After amplifying, cleaning up and frequency conversion, the signals are reassembled for transmission into the main cable network. Translators fitted in local street cabinets restore the 625-line TV signals for UHF channels and 405-line TV and radio signals for the VHF band. The outputs of these translators, in the frequency range of 80 to 700MHz, are delivered to each home by the twin cable network.

The return path transmissions will use a frequency band from 0 to 80MHz. "Upstream" amplifiers and bypass circuits are used in the main cable network to bring return transmissions to the telephone exchanges, which will contain equipment to receive, redirect and process the signals.

Viewphones can be connected into the system as they become available, and presumably, some form of video monitoring system could also be easily connected.

Akai technical advice

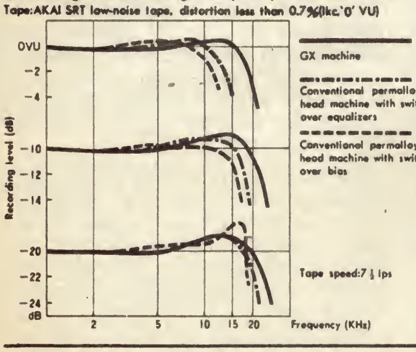


The level makes a difference.

We recommend 'high-level' recording with our GX machines. There's no high frequency deterioration.

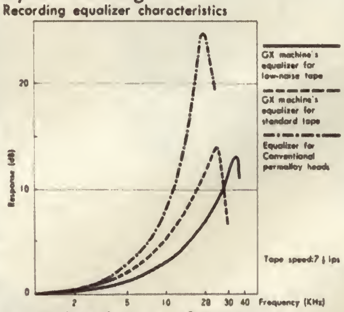
The perfect method to record modern sounds
If you record modern music you may have found that the results often leave something to be desired. Modern music contains a lot more high frequency sound than classical music, and extreme highs deteriorate in high level conventional recording even on low noise tape. So you're forced to compromise: to record at around −10dB and sacrifice your S/N ratio as the lesser of two evils. Our recording system does away with this dilemma. GX machines exhibit 50−20,000Hz response even when the VU indication is around zero. That's the main reason for GX recording's far better signal-to-noise ratio, more dynamic range and wider frequency response.

Recording levels and high-frequency characteristics
Tape:AKAI SRT low-noise tape, distortion less than 0.7%(1kc '0' VU)



The difference: new head materials and focused bias field
Our exclusive GX head contains a single crystal ferrite core set in glass. It has greatly improved precision and magnetic conversion efficiency: an ideally focused bias field that minimizes high-frequency loss, eliminates undue equalization and achieves wider dynamic range.

Recording equalizer characteristics



Long-lasting performance
Dust and magnetic particles cannot adhere to the surface of the GX head. You need never worry about recording failure from collected dust. And the head is free from wear. Showroom sound performance is maintained longer than any other head in present existence. A semi-permanent hi-fi recording with surprisingly low noise, low distortion and very wide dynamic range and frequency response.

GX-280D stereo tape deck
One of the most sophisticated models in the GX family. The 3-head, 3-motor deck features a servo-control capstan motor for negligible wow/flutter, 30−24,000Hz (±3dB) response at 7-1/2 ips (30−19,000Hz±3dB at 3-3/4 ips), switch-over equalizers for standard and low-noise tape, automatic reverse and sound-on-sound functions. There's much more. GX machines are setting higher standards for audiophiles.

AKAI ® *Audio & Video*
AKAI ELECTRIC CO., LTD.
Ohta-ku Tokyo, Japan

AKAI AUSTRALIA PTY. LTD.: 276 Castlereagh St., Sydney, N.S.W. Tel: 61-9881/146 Burwood Rd., Hawthorn, VICTORIA Tel: 81-0574/399 Montague Rd., West End, Brisbane, QUEENSLAND Tel: 4-0171/8 Arthur St., Unley, S.A. Tel: 71-1162/11-13B Belmont Ave., Belmont, W.A. Tel: 65-5833 SONNY COHEN & SON: 20 Isa St., Fyshwick, A.C.T. Tel: 9-1551 P&M DISTRIBUTORS PTY. LTD.: 87A Brisbane St., Lauceston, Tasmania Tel: 2-5282

NEWS HIGHLIGHTS

Pioneer 10 on trajectory to Jupiter and beyond

With completion of the first midcourse correction, NASA's Pioneer 10 spacecraft is on a trajectory planned to bring it to about 87,000 miles from Jupiter's cloud tops and to arrive over the planet's surface at a point 14° below the equator on December 3, 1973.

The arrival point will allow several looks at Jupiter's Great Red Spot, as the planet rotates once every ten hours, and at various parts of Jupiter's blue and orange belts and zones.

Jupiter is a spectacular planet and is so massive that it is almost a small star. It may have the necessary ingredients to produce life. Its volume is 1,000 times that of Earth, and it has more than twice the mass of all the other planets combined. Striped in glowing yellow-orange and blue-gray, it floats in space like a bright-colored rubber ball.

It broadcasts predictably modulated radio signals of enormous power. Though it has only 1/1000th the mass of the Sun, it may have Sun-like internal processes, apparently radiating about four times as much energy as it receives from solar radiation.

Pioneer 10 is the first spacecraft to be placed on a trajectory to escape from a solar system into interstellar space. It will be the first craft to fly beyond Mars, first to enter the Asteroid Belt and first to fly to Jupiter. If the spacecraft continues to function well, it may be the first to sense the interstellar gas beyond the Sun's atmosphere.

Jupiter is so far away that radio messages moving at the speed of light will take 45 minutes to reach the spacecraft there, with a round trip time of 90 minutes. Its absolute communications limit will be near the orbit of Uranus at about 1.8 billion miles from the Sun. It will reach this point in 7.5 years.

To carry out the mission, the advanced communications technology of NASA's Deep Space Network (DSN) will be strained to the limit. The DSN's 64-meter (210-foot) "big dish" antennas, one of which now hears the Mariner 9 spacecraft in Mars orbit will have to hear seven times as far as Pioneer approaches Jupiter.

Pioneer's eight-watt signal, transmitted from Jupiter, will reach DSN antennas with a power of 1/100,000,000,000,000,000 watt. Collected for 19 million years, this energy would light a 7.5-watt Christmas tree bulb for only one-thousandth of a second.

Tidbinbilla Deep Space Communications Complex is providing prime Australian support for the mission. Tidbinbilla's 26-metre (85-foot) antenna is now tracking the spacecraft 12 hours a day, 7 days a week.

There will be two breaks of about a month each when Tidbinbilla will assist the Prime Apollo station at Honeysuckle Creek in support of the Apollo 16 and 17 manned missions to the moon.

During these periods the Island Lagoon tracking station near Woomera, SA, will support the Pioneer 10 mission. Island Lagoon is currently supporting the Mariner Mars mission.

It is expected that by mid-1973 the new 64-metre (210-foot) antenna at Tidbinbilla will be in operation and can support Pioneer 10 on the latter half of its flight, as it will then be out of range of the 26m antenna. The smaller antenna can then be used to track Pioneer 11, due to be launched toward Jupiter in March-April 1973.

IRONSIDE TESTS THE TONYMOBILE. Actor Raymond Burr, who plays the wheelchair detective on TV, tests Lord Snowdon's invention — a 0.7 mph battery powered platform.

New phone system tested

Field trials are being carried out in Australia by the Oversea Telecommunications Commission (OTC) of a new signalling (dialling) system designed for future international telephone services.

The new system, called CCITT No. 6, has electronic exchanges controlled by a computer rather than the electro mechanical cross-bar exchanges now in use.

All dialling codes, system service and operational information will be on a special high speed data circuit. The present system makes use of the actual voice circuits for dialling before and after a telephone call. By reserving a special circuit for dialling, all of the available voice circuits could be used to their maximum capacity.

EXHIBITED IN NEW YORK. One of the Plessey enclosures at the IEEE show in New York was this 9-speaker, 50-watt model. All Plessey enclosures shown featured wool grille cloths in decorator patterns.

Business briefs...

CONTROL DATA will computerise the TAB in New Zealand. Under the new system, to be initially installed in Auckland, Christchurch and Wellington, both cash and telephone betting will be handled by electronic machines automatically transmitting each bet to a central computer.

AWA recently announced that the Italian Carabinieri (police force) is now its largest customer for VHF/FM test equipment. AWA is presently engaged in a marketing drive in Europe and has appointed Marconi Instruments Ltd as UK distributor for a range of test sets for communications and broadcasting equipment.

PLESSEY has sold an additional 75 ground-to-air transmitters and receivers (T39/R39 types) to the Department of Civil Aviation. Frequency range is 188MHz to 136MHz. All circuitry is solid state and includes discrete silicon transistors, high frequency ICs and dual gate MOSFETS.

FERRANTI has received an order from the Australian Department of Supply for two sets of Projectile Velocity Measuring Equipment, a type of doppler radar speed meter. The equipment measures velocity with an accuracy of 1 part in 10,000.

EXPORTERS EXHIBIT AT IEEE SHOW IN NEW YORK. Electrical and electronic exports have doubled in the past three years. Australian companies exhibiting in the IEEE (Institute of Electrical and Electronics Engineers) show in March to help boost export sales were Adcola Products, DC Industries and Plessey Rola from Victoria; Hawker Siddeley Electronics and Paton Electrical of NSW; and ODL from South Australia.

4-Channel Discs

Matrix or circuit tricks?

After years of speculation, four-channel or "quadraphonic" discs have suddenly made their appearance on the Australian market. If you're so disposed, you can buy the four-channel equipment on which to play them. But, before you decide, let's bring you up to date on the overall situation.

by NEVILLE WILLIAMS

During the 1960s two-channel stereo made a virtually clean sweep of the disc record market. At first, manufacturers offered stereo versions of their regular mono releases. Gradually stereo discs accounted for an increasing share of the market until mono discs became the poor relations.

But technology seldom stands still. During the past decade, while the vast majority of enthusiasts were listening happily to their two-channel stereo systems, a few producers, engineers and manufacturers have been dreaming about additional channels which would allow them to introduce sound sources behind the listening position, as well as in front of it.

Why do this?

To the engineer quadraphonic sound represented a technical challenge.

To the purist musician, it offered the possibility of reproducing the total ambience of the original auditorium, allowing the listener to get a little closer to the feeling of "being there."

To the producer of musical spectaculars, it offered the chance of "surround stereo", placing the listener right inside a circle of performers.

To the manufacturer, it held the promise of a whole new market activity, involving more equipment, more amplifiers, more loudspeakers.

It was assumed initially that four-channel sound would have to be recorded and reproduced from tape. Thus the initial engineering effort was aimed at evolving suitable multiple heads and adapting existing stereo tape equipment to record and play four parallel tracks.

And since the tracks could be entirely separate, each as important and distinct as the other, such a concept was commonly described as "discrete" four-channel sound.

As far back as 1961, the Nortronics Company in the USA sought to introduce their "stereo-Four" discrete tape system but it was clearly ahead of market demand.

Then, around 1969, there was a new flurry of interest in four-channel tape around the well known names of Vanguard, Acoustic Research and Columbia. There were demonstrations around the world, magazine articles, the announcement of four-channel equipment and tapes but that was about as far as it went.

Commercially, the message seemed crystal clear: consumers were simply not ready to step directly from two channels on disc to four channels on tape.

What was necessary was a method of impressing four channels on disc — but in such a way as to be compatible with present stereo players. Customers could then be expected to migrate, in their own good time, from two channels to four — just as they had done from mono to stereo.

But how could four sets of information possibly be impressed on a groove which geometrically seemed capable of responding only to two sets of information? It seemed impossible — or at least impractical.

There was also the question of stereo FM broadcasting. Here was another audience locked to two-channel sound. Somehow, another two channels had to be loaded on to the carrier without compromising existing services and equipment. It seemed like a paralleled problem: solve one and you have most likely solved the other.

In 1969, Peter Scheiber, an enthusiast-engineer-musician announced that he had devised a method of compressing four sets of audio information into two channels, which could then be recorded in the ordinary two-channel stereo format.

He claimed that the recording could be played either as a two-channel disc or, with supplementary decoding equipment, as a four-channel source. Moreover, the same encoding and decoding principle would be applicable to twin-track tape and stereo FM broadcasting.

Industry was cautious at first, even dubious, but demonstrations seemed to establish the validity of his claims. But what of the patent situation, rights, royalties and all that? Here was a challenge for the engineers and management of any number of large hi-fi concerns. Laboratories around the world turned their attention to "4-2-4" audio: four channels into two, then back into four.

One by-product of this concentrated effort was a rash of systems aimed at synthesising a four-channel sound from existing two-channel recordings. The method suggested by David Hafler was relatively simple (see "Electronics Australia", April 1971). Others, like the Sansui QS-1, were quite complex in their approach ("Electronics Australia," September 1971.)

The 2-2-4 approach (two initial signals, two channels, 4 outputs) offered a link between existing program material and 4-channel replay equipment but it was commonly viewed as a short-term expedient. In fact, for reasons which will become apparent later, there is more affinity than might first be expected between these 2-2-4 systems and some of the commercial 4-2-4 approaches which have evolved from Scheiber's proposals.

Scheiber's basic approach to the problem of compressing four signals on to two channels is by the use of a matrix network, which is shown in generalised form in Fig. 1. It is assumed that a complementary matrix will be provided to recover the four signals from the two-channel medium at the point of replay. More of that later, however.

While it was aimed primarily at solving the problems of disc recording, the idea of matrixing is equally applicable to ordinary stereo tape equipment and stereo FM broadcasting. A matrixed signal contains only audio frequencies and only two channels, and it can be copied and transmitted just like any other two-channel stereo. Only in the listening room does it need to be decoded and reproduced as four channels.

It is interesting to note, in passing, that

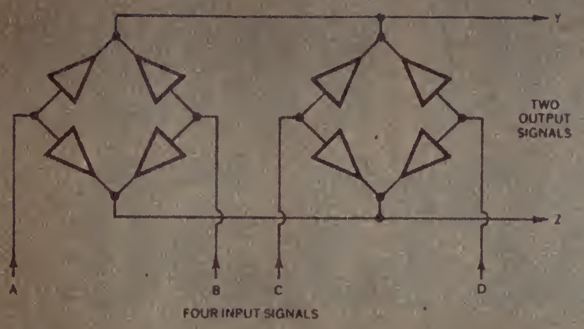


Fig. 1: A basic 4-2 encoding matrix, from four channels to two channels. The proportions of A,B,C & D which appear on Y and Z depend on the gain and phase characteristics of the individual matrix amplifiers.

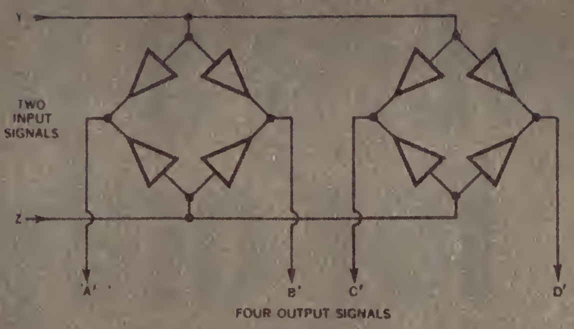


Fig.2: A 2-4 decoding matrix, from two channels to four. Note that the output signals are branded as A', B', C' & D', implying that they are not identical with the original input signals A,B,C & D.

even a mono input signal via any one channel will tend to place a signal on both Y and Z. A two-channel stereo via any two channels will tend to place two signals each on Y and Z.

Considering the 4-2 (four-to-two) matrix of Fig. 1, four input signals A,B,C & D are fed through amplifiers to the two output channels Y & Z. It is for the designer of the matrix to determine what shall be the relative gain of the respective matrix amplifiers and their phase and frequency characteristics.

The options in designing a matrix are almost endless. If, for example, the amplifiers all had the same gain and phase

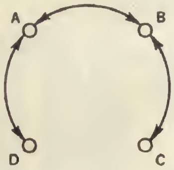


Fig.3: Three independent signals can be impressed on a four-wire system and be recovered without significant cross-talk.

characteristics, equal proportions of all four input signals would appear on each of the two output lines. This would obviously be a rather pointless result, since the four inputs would simply have been mixed into two indentical mono channels!

However, by setting up the amplifiers with different orders of gain, certain of the input signals can be made to dominate one or other of the output channels.

Again, by reversing the output phase of one or more of the amplifiers, certain input signals can appear on the output lines in opposite phase.

In fact, the designer can do virtually anything he sees fit to any of the matrix amplifiers, in terms of gain, phase, frequency response or dynamic characteristics, to obtain what he judges to be the most desirable end result.

Certain requirements have to be observed, however, if that result is to be compatible with present-day two-channel stereo systems, or with older mono players or for mono broadcasting.

If signal A is intended for the left-front loudspeaker, it should clearly dominate, say, output channel Z so that it will be reproduced in the left-front loudspeaker of an existing two-channel stereo system.

Similarly, if signal B is intended for the right-front loudspeaker, it should clearly dominate output channel Y.

If too large a sample of input A should appear on output Y, or too much of input B should appear on output Z, the apparent separation in ordinary stereo mode would be prejudiced.

The influence of signals C and D also has to be considered. If C happens to represent the left-rear signal, it might conceivably be allowed to mix with the left-front on line Z, with D going to line Y. Again, too much of C and D on the opposite output lines could upset normal stereo separation.

Here the matrix designer faces a dilemma. He must allow a fairly generous mix of all four inputs on the two output lines if he is going to achieve his ultimate goal of unscrambling them into four signals. Yet too generous a mix could result in a record with such debased separation in ordinary stereo mode that it would not be acceptable to customers who have their own ideas as to how a two-channel record should sound!

Hence the idea of playing tricks with the phase of the mixed signals. By putting the "unwanted" component on the respective channels in reverse phase, the subjuctive effect may be to increase the apparent separation. The engineer has the option of putting either or both B and D on line Z in opposite phase, setting the level so that the subjective separation in two-channel stereo mode is adequate.

But there is still another important consideration: what happens when output lines Y and Z are paralleled as for mono reproduction? Components which are equal and out of phase on the two lines will cancel and virtually disappear. The end result could be that the total output signal is lowered to an unacceptable level by cancellation. Worse still, vital musical information might virtually disappear.

Along with this is the uncomfortable possibility that incomplete concellation, the result of phase aberration, could leave remnants of the cancelled signals to be interpreted as odd sounds or straight-out distortion

To sum up what has been said, a recording engineer, in aiming for an ultimate four-channel recording, has to make sure that the matrixing will provide a completely acceptable result, when played in normal stereo and mono mode. It this is not achieved, the recording will lose its appeal for the existing mass player market and for mono broadcasting, defeating the whole concept of compatibility.

These requirements notwithstanding, the ultimate objective is, of course, to produce a two-channel signal which can be decoded into four signals, hopefully equivalent to the original A,B,C & D.

This involves a matrix network as in figure 2, being the converse of Fig. 1. The two input signals are fed into Y and Z and emerge as signals A, B, C & D.

At this point, the reader can be excused for demanding a re-statement and verification. It is one thing to mix signals but how can they be separated out again if they have not been "tagged" in some way in terms of frequency (as by a carrier system) or time (in terms of time multiplexing)?

In fact, it would be quite a task to analyse the operation of a decode matrix in so many words, and without resource to copious and tedious algebra. However, it may be helpful, in resolving the difficulty, to realise that, by proper segregation of wiring, two channels can provide the equivalent of a four-wire AC circuit: four wires into the record head (tape or disc) and four from the replay head.

With four wires available there is no special problem in conveying three separate signals (between D-A, A-B, B-C) as in Fig. 3. Most likely, three phases of the ordinary power mains are carried into your home on four wires for independent use. There is certainly nothing new about this and, if the record manufacturers had been content to settle for a tri-phonic system, further difficulties might largely have been avoided.

But they weren't content and, to match the challenge of the tape medium, they insisted on introducing a fourth signal. In terms of a basic four-wire circuit, it in-

volves introducing a signal between C and D, as in Fig. 4a.

This closes the loop and, fairly obviously, some of the new signal voltage between C and D will be distributed across the other paths D-A, A-B and B-C, in proportions depending on the relative impedance levels.

By exactly the same reasoning the voltage between B and C will distribute around C-D, D-A and A-B. The same will be true of the remaining channels.

Because of this interaction, it will no longer be possible to pick off from A-B a simple signal, as would have been the case for Fig. 3. As indicated in 4b, the signal across A-B must contain a proportion of the signals B-C, C-D and D-A. In turn, the signals across each of these other channels must be similarly "polluted."

It is for this reason that the outputs from the decode matrix are designated as A', B',

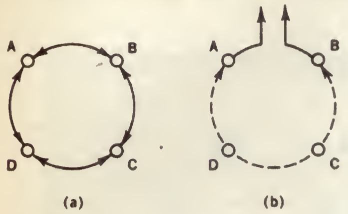


Fig.4: Problems arise when a fourth signal is introduced on to a four-wire system (a). The signal recovered from A-B, as shown in (b), is no longer pure but is polluted by elements of the other three signals.

C', & D'. The implication is that they may relate to, but will differ from A, B, C & D.

What would seem to emerge from this is that a two-channel (four-wire) system can carry, at most, only three discrete (or separate) signals. The penalty of trying to handle four signals is a high order of cross-talk.

Not satisfied with mere words and generalities, Editor Jim Rowe took it on himself, while this article was being written, actually to work out typical figures, starting with the original Scheiber matrix. Several sheets of paper later, he was convinced that elements of the original signals could in fact be recovered from a 2-4 matrix, but only with a significant degree of cross-talk which, in some cases, could be within 3dB of the wanted signal!

How small that figure sounds to enthusiasts who are apt to frown if the cross-talk in a stereo pickup falls below 20dB!

As we have indicated, the encode and decode matrices can be manipulated within wide limits, and the phase of the signals varied to achieve different orders of cross-talk between different channels. However, measures to decrease cross-talk between certain channels are likely to increase it between others.

No one has yet succeeded in developing a 2-4 matrix which is free from this problem, despite impressions to the contrary which might be created by euphemistic articles and advertisements.

Proponents of the matrix system admit to the cross-talk problem but claim that it is not nearly as serious, subjectively, as the figures might suggest. Frontal left-right

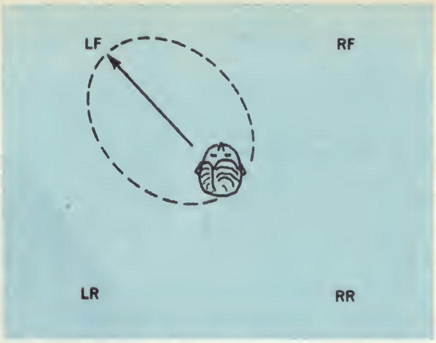


Fig.5: If a signal intended only for the left-front loudspeaker (LF) is reproduced at lower level in loudspeaker RF and LR, the sense of direction, represented by the arrow, becomes broad and vague (ellipse) to a degree governed by the amount of cross-talk.

separation has to be preserved but they claim that a quite small loudness difference between the front and rear channels on the respective sides is adequate.

From this point on, the literature is full of ideas for "processing" the respective signals in order to achieve the most acceptable end result. Nor is it immediately clear as to how many of these ideas are theoretical proposals and how many are actually incorporated in existing or emergent matrix systems.

One broad approach, which seems to have been dignified by such terms as "logic" and "digital", is virtually an expander system. In-built circuitry senses signals which are unique to particular channels and seeks to emphasise those signals by a dynamic change in gain of the appropriate amplifier path.

Another approach, as already mentioned, is to reverse the phase of certain signals in certain paths, so that they tend to cancel rather than add. By this means, for example, a signal intended for the respective front loudspeakers may be eliminated specifically from the diagonally opposite rear loudspeaker, though it will still be present as cross-talk in the right front and left rear.

Such cross-talk tends to broaden the apparent sound source for the particular signal, as illustrated in Figure 5. While this may not be important to a listener in a near optimum position, it will lead to problems for listeners elsewhere in the room. As the listener moves towards right-front or left-rear, they will hear more of the intended signal from that particular loudspeaker. The apparent sound source will move towards that loudspeaker and might ultimately be identified with it.

In fact, it is possible to derive a whole series of apparent sound source patterns for typical matrix networks and, in particular, those which satisfy the basic requirements stated earlier for quadra / stereo / mono compatibility. For good measure, these can be expanded to take in what is claimed to be a major difference in the ability of listeners to discern sound sources in front of them and behind then.

What emerges from this kind of analysis is that a matrix system can be devised readily enough which will satisfy the basic mono / stereo / quadra requirement for a strong cente-front sound image and acceptable left / right frontal spread.

But having satisfied this basic requirement, it is difficult to produce a firm, isolated image from the respective rear loudspeakers and even more difficult to create an even sound spread across the rear wall. There is a strong tendency for sounds intended for the centre rear to be interpreted as coming from centre front.

The technique, which was mentioned earlier, of reversing the phase of some signal components has a complex effect. Electrically, it can produce actual cancellation of signal components to diminish the severity of particularly troublesome cross-talk.

Acoustically, there is the possibility that a deliberate anti-phase component may tend to confirm a listener's judgment that a particular sound is NOT coming from a particular direction. Fairly obviously, this kind of thinking cannot be pushed too far, because phase tends to become random once sounds have been projected into the listening room.

However it is obvious that, having manipulated matrix constants, gain and phase reversals to the limit, some engineers have still not been satisfied with the end result. They have accordingly resorted to other tricks of electronic circuitry. One of these is illustrated in basic form in Fig. 6.

It involves a transistor amplifier operating into a split load such that the signals at collector and emitter are of equal amplitude but opposite phase. The actual output is taken from the junction of an R / C network between the two.

Depending on the choice of constants, the output can be arranged to exhibit a 90-

To: International Dynamics (Agencies) Pty. Ltd. P.O. Box 205 Cheltenham, Vic 3192

Please send information on Lux 503X

NAME..

ADDRESS...

8589EA

send coupon now

for information on

LUX 503x

and that X means plenty!

or hear it at

The Lux 503 was an uncompromising performer. Now comes LUX 503X with a standard of performance that goes one better! With their long lead in amplifier manufacture, Lux gives a wonderful answer to the demand for high fidelity and economy. 503X uses 27 transistors, 2 silicone varisters and 4 silicone diodes. The main amplifier section adopts a fully-complementary direct coupled output with differential amplification, and with Lux' exclusive circuit device, together with the toughest power transistors, full protection and stability is assured. RMS power is 30 + 30 watts. Total harmonic distortion is less than .04%, frequency response 10 — 80,000 Hz, less than — 1dB. Phono overload 210 mv margin. Two sets of recording output connectors, tape monitor switch enables simultaneous tape playback and monitoring on 3 head recorder.

INTERDYN

Sole Australian distributors

International Dynamics (Agencies) Pty. Ltd.
PO Box 205, Cheltenham, Vic. 3192.

Selected Interdyn agents

N.S.W.:	**Encel Electronics Pty. Ltd. 260 Elizabeth St., Sydney.**
Q'LD:	**Stereo Supplies, 100 Turbot St. Brisbane, 4000**
S.A.:	**Challenge Hi-Fi Stereo, 6 Gays Arcade, Adelaide.**
TAS:	**Audio Services, 72 Wilson St. Burnie. 7320**
VIC:	**Encel Electronics Pty. Ltd. 431 Bridge Rd. Richmond. 3121.**

degree phase shift at some particular frequency in the audio range. At higher frequencies, the phase will approach that of the collector; at lower frequencies it will approach that of the emitter.

By upending the R / C network, the phase would rotate in the opposite manner.

Networks like this may, for example, be introduced into the signal path for the rear loudspeakers if the intention is to blur their sound image and create a more effective feeling of ambience.

But that is not the end.

In Figure 7, an LDR has been introduced so that the phase of the output signal can be subjected to external control. Electronic

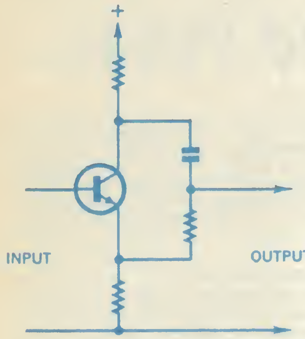


Fig.6: This type of circuit can rotate the phase of an audio signal by 90 degrees at a particular frequency and by differing amounts at other frequencies.

organ fans will recognise the circuit immediately as the basis of electronic phase modulation, as applied to organs and other such instruments.

With such a circuit, the phase of selected channels can be rotated in response to an external cyclic signal (as per the electronic chorale in an organ) or it can be modulated by a voltage derived from the signal itself.

This statement, along with Figures 6 and 7 take the mystique out of drawings which refer to spiral groove modulation. By shifting the phase of certain drive signals to the cutter by 90 degrees a certain "radial" or "spiral" quality may be given to the groove but that does not obviate the cross-talk problem. In the ultimate, the cutter and the replay stylus know only two vectors and signal current can only be translated into and out of these two vectors. This simply means two channels nothing more and nothing less.

What is apparent from all this is the enormous range of options open to recording engineers, and the opportunities for as many "standards" as there are studios. What chance has the record buyer of identifying the original encode matrix used and selecting the appropriate one for decoding?

In fact, it would not seem out of place to ask whether, in certain cases, there is such a thing as "an appropriate one for decoding." From within the industry, critics of the whole approach claim that it is rapidly moving into the area of electronic processing, with the result supposedly justifying the means.

There is talk overseas of switchable replay matrices and claims of universal matrices which give an acceptable result with all present matrixed quadraphonic records. But, right now, the vagueness threatens to be of far greater magnitude than it was twenty years back, in relation to compensation curves!

There is this difference, however: in the matter of compensation curves the enthusiast was matching one curve with another in the reasonable hope of obtaining a fairly accurate end result. With matrixed quadraphonic, the intangibles are far more numerous and the end result can only be a compromise which has all the built-in limitations of having tried to cram in one channel too many.

Subjectively, the end result may be acceptable, even very pleasant, but, at the grass roots, the whole structure of compromise and subjective reaction is at cross purposes with the true aims of high fidelity reproduction.

Maybe it is progress, but in a rather oblique direction!

And here, rather curiously, we find ourselves almost back to something referred to earlier in this atricle: to methods of processing existing stereo recordings to extract and exploit rear ambience and other effects. Basically, these depend on extracting the difference between the left-front and right-front stereo signals and reproducing this difference at

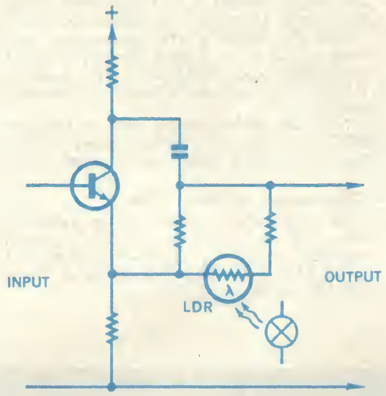


Fig.7: This phase modulator circuit, well known to electronic organ enthusiasts, has made its appearance in the context of quadraphonic matrixing!

the back of the room from out-of-phase loudspeakers.

It can be done quite simply, as per our earlier reference, using a couple of extra loudspeakers.

Alternatively, the L and R signals can be fed into a supplementary combining unit, allowing them to be "fiddled" to a greater or lesser extent, using some of the techniques already referred to. This done, they can be passed to a supplementary stereo amplifier driving a pair of loudspeakers at the back of the room.

It may well be that, in may cases, the end result will not be all that different from that obtained using matrix techniques.

Simulated quadrophonic should therefore not be written off as a superseded gimmick. It is a significant and still useful step in the direction of matrixed quadraphonic.

But matrixed quadraphonic is not the

(Continued on page 127)

THE NEW ADC-XLM

ADC XLM

SUPERB PERFORMANCE
LOWEST MASS
UNBEATABLE PRICE
AND ITS GUARANTEED FOR 10 YEARS

If you're like most audiophiles, you've probably spent a great deal of time, effort and money looking for the "perfect" cartridge.

We know what you've been through. After all, we've been through it ourselves.

That's why we're especially enthusiastic about our newest cartridge, the ADC-XLM. It does everything a well designed cartridge should do. It may not be perfect, but we don't know of any that are better, and few that even come close.

Now, we'd like to tell you why.

The lighter, the better.

To begin with, it is generally agreed that the first consideration in choosing a cartridge should be low mass. And as you may have guessed by now, the LM in our model designation stands for low mass.

Not only is the overall weight of the ADC XLM extremely low, but the mass of the all-important moving system (the stylus assembly) is lower than that of any other cartridge.

Translated into performance, this means effortless tracking at lighter pressures with less distortion.

In fact, used in a well designed, low mass tone arm, the XLM will track better at 0.4 gram than most cartridges at one gram or more.

A new solution for an old problem.

One of the thorniest problems confronting a cartridge designer is how to get rid of the high frequency resonances common to all cartridge systems.

Over the years, various remedies have been tried with only moderate success. Often the cure was worse than the disease.

Now thanks to a little bit of original thinking, ADC has come up with a very effective solution to the problem. We use the electromagnetic forces generated within the cartridge itself to damp out these troublesome resonances. We call this self-correcting process, "Controlled Electrodynamic Damping," or C.E.D. for short.

And if it seems a little complicated, just think of C.E.D. as a more effective way of achieving lower distortion and superior tracking, as well as extending frequency response.

Naturally, there's much more to the new ADC-XLM, like our unique induced magnet system, but let's save that for later.

Guaranteed reliability plus.

At ADC we've always felt that reliability was just as important as any technical specification. That's why we now guarantee every ADC-XLM, exclusive of stylus, for a full ten years.

But this unprecedented guarantee involves something more than just an assurance of quality. It is also an expression of our conviction that the performance of this cartridge is so outstanding that it is not likely to be surpassed within the foreseeable future.

And something more.

In addition to the superb ADC-XLM, there is also a new low mass ADC-VLM, which is recommended for use in record players requiring tracking pressures of more than one gram. The cartridge body is identical for both units, and so is the guarantee. Only the stylus assemblies are different. Thus you can start out modestly and move up to the finest and still protect your investment.

And that brings us to the important question of price, which we are happy to say is significantly lower than what you might reasonably expect to pay for the finest. The suggested list price for the incomparable ADC-XLM is $77 and the runner-up ADC-VLM is only $63.

But no matter which low mass ADC you choose, you can be certain that they share the same outstanding characteristics. . . superb tracking, very low distortion and exceptionally smooth and extended frequency response.

IF IT'S BETTER SOUND IT'S....

ADC

Interstate Distributors:—

NSW: Electronic Parts Pty Ltd, 91a York St, Sydney.
SA: The Muses Pty Ltd (Sound Spectrum), 33 Regent Arcade, Adelaide.
Qld: Brisbane Agencies, 72 Wickham St, Valley, Brisbane.
WA: Arena Distributors (Australia) Pty Ltd, 196 Adelaide Tce, Perth.
Victoria, Tasmania & NT: J. H. Reproducers Co.

National Distributors:

J. H. REPRODUCERS CO,

293 HUNTINGDALE RD, CHADSTONE, VIC. 3148.
TELEPHONES: 277-3066, 277-3488.

Laser light lifts glass

In their search for better ways to measure light-scattering losses in optical communications systems, American scientists have caused solid glass particles to rise and float in air, supported by a laser beam. At left, Arthur Ashkin, head of Bell Labs physical optics and research department, watches the levitation experiment.

Using a beam of laser light, Bell Labs Scientists have raised small transparent glass spheres off a glass surface and held them aloft for hours in a stable position.

As announced in our March issue, the experiments which demonstrated optical levitation for the first time were conducted by Arthur Ashkin and Joseph Dziedzic of Bell Labs, Holmdel, N.J.

The new technique is expected to provide simple, precise methods for manipulating small particles without mechanical support. It could be useful in communications research to measure scattering loss caused by particles, either in the atmosphere or in other transmission media. Such measurements may help in developing optical communications systems for the future.

In their experiment, Ashkin and Dziedzic focus a laser beam upward on a tiny glass sphere about 20 microns in diameter (.02mm or about .001in). Radiation pressure from the light not only counteracts gravity and raises the particle, but also traps the sphere in the beam and prevents it from slipping out of the beam sideways. In the experiment, which has been successfully demonstrated in air and in a partial vacuum, they thus generate a stable optical trap for holding particles which they term an "optical bottle."

"Light photons have momentum as well as energy," Dr Ashkin, head of Bell Labs physical optics and research department, says. "When we focus a quarter-watt laser on a small transparent particle, the extremely small force exerted by light is then sufficient to lift the sphere off the surface and suspend it."

The sphere is launched by lifting it off a transparent glass plate with the light beam. Initially, radiation pressure is not sufficient to overcome molecular attraction between the sphere and the glass plate. This attraction, known as Van der Waals force, is about ten-thousand times gravity for a 20-micron sphere. For this experiment, the Van der Waals attraction is broken acoustically by vibrating a ceramic cylinder attached to the plate.

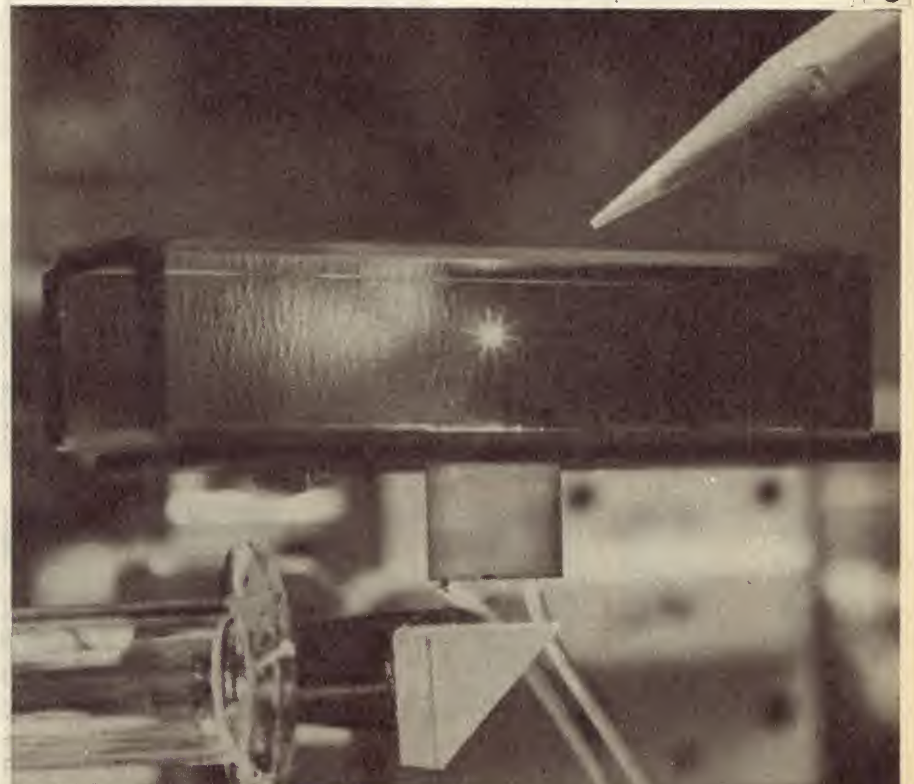
When the attraction is broken, the sphere rises in the light beam and comes to rest where the upward pressure caused by the laser is balanced by the earth's gravity. In this position, it can be held aloft as long as the light is focused on it. By changing the position of the focus, the trapped sphere can be moved up and down or sideways very precisely.

In the experiment, these trapping forces were also studied, using a second laser focused on the particle from the side. As the power of the second laser is increased, the particle is displaced within the first beam until it is finally driven out and falls.

"Any laser will produce the levitation effect," Dr Ashkin says. "However, the particle is preferably transparent. If the beam were focused on objects that absorb light, most would melt. By remaining cool, the transparent sphere allows radiation pressure to be studied without any disturbing thermal effects."

The laser levitation technique may also be a valuable research technique for suspending particles in optically induced thermonuclear fusion experiments.

When used in an evacuated environment, where damping effects on the particle are negligible, the technique may also have applications in inertial devices such as gyroscopes and accelerometers.



"OPTICAL BOTTLE" HOLDS PARTICLE ALOFT. Laser light passing through a lens at the end of the glass tube is being bent by the prism to focus on the glass particle from below. The laser light forms an optical trap or "optical bottle" for holding the particle.

Sync & Pattern Generator for TV

Use it for adjusting colour TV convergence, for interlocking closed-circuit TV cameras, or as master sync and blanking generator for amateur TV

First of two articles by JAMIESON ROWE

A sync pulse generator or SPG is almost essential in closed-circuit TV work whenever two or more cameras are to be used together. Unless the cameras are locked to a single and stable source of sync signals, any attempt to switch from one camera to another will result in annoying picture rolling and / or tearing. Such effects are particularly embarrassing where the cameras are to be used with a videotape recorder or VTR.

When the cameras are locked together by means of an SPG, most of these effects are eliminated, and switching between cameras can be performed with great ease.

The sync pulse generator to be described has been designed to deliver all of the sync and blanking signals necessary to lock a number of CCTV cameras together. It generates pulses which are derived from a quartz crystal master oscillator, and locked accurately in frequency and phase relationships corresponding closely to the 625 line / 50 field 2:1 interlace Australian TV standards.

Although the vertical sync and blanking pulses generated by the unit are simplified for reasons of economy, compared with the Australian standards, they are sufficiently close to operate entirely satisfactorily with the majority of TV receivers and monitors. This is discussed in further detail shortly.

Apart from its use in CCTV work, another application for which the unit would be well suited is as the master sync generator of an amateur television (ATV) station. The regulations covering ATV standards in Australia specify that normal (wideband) television signals radiated in the 420-450MHz and higher amateur bands must have 625 lines per picture, 25 pictures and 50 fields per second, with a 2:1 interlace. To conform with these requirements it is really necessary to use a synchronising reference such as the SPG described here.

In addition to providing sync and blanking signals, the unit has also been designed to generate a number of stable video test patterns. These include signals producing horizontal lines, vertical lines, a spaced dot pattern, a vertical white bar, and bars modulated with high frequency square waves. The availability of these signals makes the instrument also suitable for checking, servicing and adjusting TV receivers and monitors, both monochrome and colour.

For example sweep linearity testing and adjustment are readily carried out using the horizontal and vertical line patterns. Similarly the vertical white bar is very convenient in testing for low frequency response and smearing, while high frequency response may be checked using the HF modulated bars.

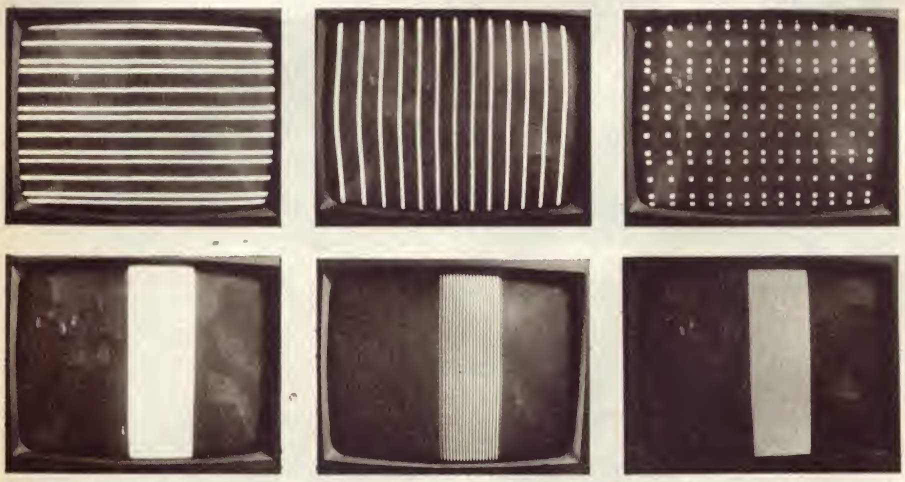
The spaced dot pattern is quite suitable for convergence testing and setting-up on both NTSC and PAL colour receivers and monitors using the RCA shadow-mask tube. Convergence adjustments on colour receivers and monitors using the Sony Trinitron or similar tubes may be done using the vertical lines pattern.

The unit described in these articles is therefore not simply an SPG for use in multi-camera CCTV systems and ATV stations, but a flexible device which should also find lots of uses in both monochrome and colour TV servicing. It should have considerable appeal for the TV service technician wishing to prepare for the forthcoming commencement of colour transmissions, particularly as its cost will be very much less than that of equivalent commercial units.

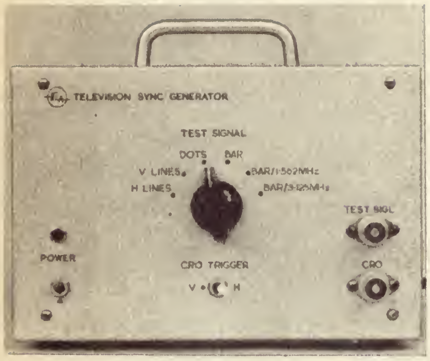
The synchronising and blanking pulses generated by the unit are shown in Fig. 1, which also indicates the Australian standards for comparison. It may be seen that for all practical purposes the horizontal sync and blanking pulses conform accurately to the standards. The vertical sync pulse does not conform to the standard, however, being a simplified single pulse rather than the specified "block" synthesised from widened horizontal sync pulses. It is not preceded by pre-equalising pulses, nor followed by post-equalising pulses.

The main effect of this simplified vertical sync pulse is that it virtually obliterates the concomitant horizontal sync pulses, so that the horizontal sweep system of the receiver or monitor receives no synchronising pulses during the 2.5-line vertical sync interval.

While at first sight this may seem likely to have a drastic effect upon picture stability, this does not occur in practice. The vast majority of modern receivers and monitors accept the situation without any obvious weakening of picture stability. In the rare cases where this does occur, usually the only visible effect is a slight horizontal displacement or jitter of the first few lines at the top of the picture.



The six test pattern signals supplied by the instrument in addition to horizontal and vertical sync and blanking. The vertical lines and dot pattern may be used for setting up colour TV convergence, while the other patterns may be used for linearity and frequency response tests.



The completed generator, full details of which will be given next month.

Probably the main reason why the simplified vertical sync pulse causes so few problems in practice is that the sync circuitry used in modern receivers and monitors does not really need the pre- and post-equalising pulses to lock reliably, while modern horizontal AFC circuits are capable of recovering sufficiently rapidly after a 2-line loss of sync to produce no visible embarrassment.

Any disturbance to the horizontal oscillator of the receiver or monitor caused by the loss of horizontal sync pulses during the vertical pulse is generally fully corrected before the start of the first active scanning line of the next field. This is helped by the fact that the "back porch" section of the vertical blanking pulses delivered by the SPG happens to be three lines longer than the maximum specified in the Australian standards — 20 lines instead of 17.

But why are we seeking to justify this simplified vertical sync pulse, and its longer-than-usual blanking pulse? Why doesn't the SPG deliver the standard pulses? The reason is quite simple: cost. To provide a fully synthesised vertical sync block complete with pre- and post-equalising pulses and a standard blanking pulse would involve a considerable increase in circuit complexity, and the cost of the unit would rise significantly. In view of the largely academic advantage which would be gained, the author does not regard this as justified.

It should be remembered that the vast majority of CCTV cameras in use deliver a simplified vertical sync pulse very similar to that produced by this unit. In many cases the sync pulses delivered by such cameras are not even "protected" by properly-shaped and accurately timed blanking pulses, as they are here. Yet the signals delivered by such cameras are still locked quite satisfactorily by most modern receivers and monitors.

The operation of the unit will now be described.

In order to produce the horizontal and vertical sync pulse trains required for a locked 2:1 interlace 625-line / 50 field television system, one must derive both these trains from a common 31.250kHz source. The horizontal sync pulses are derived from this source by means of a x2 frequency division, while the vertical sync pulses are

derived by means of a x625 division. Note that the vertical pulses cannot be derived directly from the 15.625kHz horizontal frequency, because this would involve a division by 312½ — rather difficult!

The basic requirement for an SPG, then, is a stable and accurate source of 31.250kHz. Perhaps the most obvious way of providing this would be to use a 31.250kHz quartz crystal in a suitable oscillator circuit. However crystals cut to oscillate at this part of the frequency spectrum tend to be very expensive. From the point of view of cost it is therefore preferable to generate a signal at a suitable multiple of this frequency, and divide down to the required 31.250kHz using low-cost IC dividers.

There tends to be a broad trough in the cost of quartz crystals in the vicinity of 2 — 5MHz, so that in general it is desirable to pick a crystal frequency in this area. One possibility which suggests itself is to use a 2MHz crystal, with a string of 6 simple binary x2 dividers using flip-flops. This will give 31.250kHz very simply, as this frequency is equal to 2MHz divided by 64.

While this method is probably the cheapest way of producing a crystal-derived 31.250kHz signal, it suffers from a disadvantage as far as an SPG design is concerned. This is that the intermediate signals available on the frequency divider chain do not lend themselves to convenient synthesis of the horizontal sync and blanking pulse waveforms.

The crystal frequency actually used in our generator is 3.125MHz. As this is simply 100 times the desired 31.250kHz, the divider system used is thus two low-cost decade stages. While these stages involve two more divider flip-flops than would be required for the simple 2MHz / x64 divider method, the advantage is that certain intermediate frequency signals lend themselves to easy synthesis of the horizontal sync and blanking pulses.

As mentioned earlier, the basic horizontal pulse repetition frequency is derived from the 31.250kHz signal by a x2 frequency division, while the vertical frequency is derived by a x625 division. The latter division ratio is provided by four x5 dividers in cascade. The basic sync divider system of the SPG is thus as shown in Fig.2.

Like the x10 divider stages used in the initial part of the chain, the x5 stages used to derive the vertical frequency use a very economical logic configuration. Thus the complete x625 vertical divider chain uses only 12 flip-flops.

Of course the derivation of the horizontal and vertical scanning frequencies is only part of the story, because it is then necessary to synthesise the corresponding sync and blanking pulse waveforms. These must not only have an acceptable shape, but must also be in the correct phase relationships to each other.

The basic method used in the SPG to synthesise the horizontal sync and blanking pulses is shown in Fig. 3. The blanking pulse is produced by using the basic 15.625kHz signal to gate a train of 12.8us-long pulses available at the output of the second x10 divider stage. The blanking pulses are then used to gate a train of 5.12us-long pulses produced by a simple logic circuit from two signals taken also from the second x10

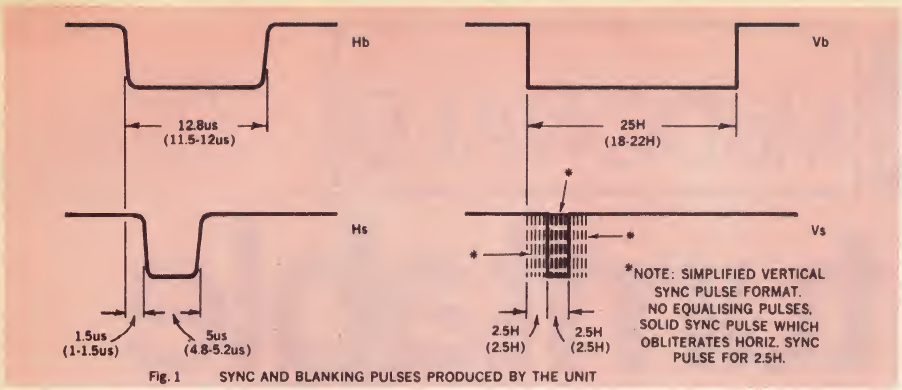


Fig. 1 SYNC AND BLANKING PULSES PRODUCED BY THE UNIT

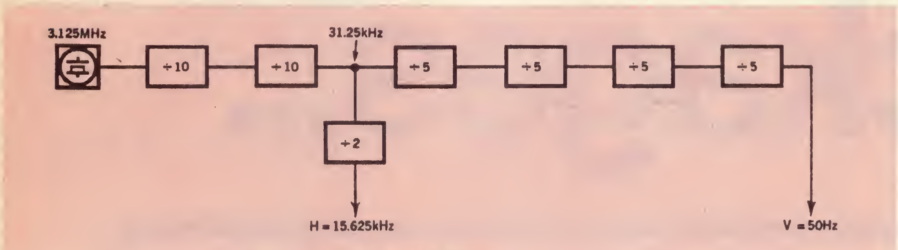


Fig. 2 BASIC SYNC. DIVIDER SYSTEM

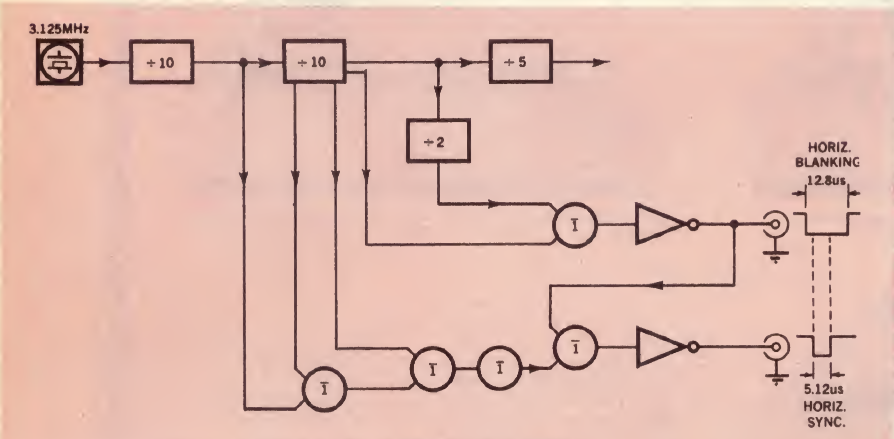


Fig. 3 SYNTHESIS OF HORIZ. BLANKING AND SYNC. PULSES

divider stage, together with the 312.5kHz signal at the input of this stage. Both the sync and blanking pulses are fed through inverting buffer amplifiers after being synthesised, to provide a low impedance source.

A similar system is used to synthesise the vertical sync and blanking pulses, as shown in Fig. 4. Here the 50Hz vertical signal from the end of the x625 divider chain is used to gate a train of pulses picked off from the last x5 divider section, and the resultant pulses are then used to gate a train of pulses of 25-line duration to produce the vertical blanking pulses.

As before the blanking pulses are then used to perform gating for the sync pulse synthesis. In this case the pulses gated by the blanking pulses are taken from the second and third x5 divider stages, one of the signals being used to gate a third signal taken from the output of the third divider stage before being fed to the main logic gate. The synthesised blanking and sync pulses are again fed through inverting buffer amplifiers to provide a low impedance source.

As well as providing the individual horizontal and vertical sync and blanking pulses, the SPG is also arranged to deliver a composite blanking signal. Such a signal is very useful for CCTV and ATV applications, as it can be used for such purposes as camera blanking, hard video clamping, etc. The simple logic circuitry used to derive the composite blanking is shown in Fig. 5.

The video test pattern signals produced by the SPG are generated by the further logic and circuitry shown in Fig. 6. The two switch sections Sla and Slb select appropriate signals from the main frequency divider chain of the unit, and feed these into a three-input NOR gate where they are gated by the composite blanking signal. This produces the test pattern logic signal Tp used to generate the final video signal.

For horizontal lines, Sla is used to select a train of 5-line long pulses derived from the second last x5 divider stage. For vertical lines, Sla is again used, but this time to select a 312.5kHz signal from the junction of the x10 dividers. For the dot pattern both of these signals are used, one selected by Sla and the other by Slb, and advantage is taken of the fact that the 3-input NOR gate is acting here as an effective "AND" gate. Output is thus produced only when both signals are "low", to produce dots corresponding to the intersection of the vertical and horizontal lines.

BSR McDONALD

total turntable packages...

MP60 four speed heavy balanced die cast turntable with viscous cue (single play) $120.00 + cartridge.

610 heavy balanced diecast turntable auto/manual turntable viscous cue $125.00 + cartridge.

510 deep rim turntable auto/manual viscous cue $115.00 + cartridge.

- ☐ *7", 10" or 12" diameter records.*
- ☐ *78, 45, 33 and 16 r.p.m.*
- ☐ *Synchronous 4 pole motor to suit either 100-125 or 200-250 volt 50 cycles mains supply.*
- ☐ *Fitted with a high compliance magnetic cartridge the unit will track down to a minimum of 1 gram.*
- ☐ *Rumble — better than -35dB.*
- ☐ *Wow — better than 0.2% (Gaumont Kalee meter).*
- ☐ *Flutter — better than 0.06% (Gaumont Kalee meter).*
- ☐ *Satin black mainplate finish with black turntable mat inlaid with brushed aluminium trim. Pickup arm and controls in black and brushed aluminium.*

• Prices apply in Australia only.

and our total turntable concept...

Now you can buy any one of these three fine turntables professionally mounted on an attractive plinth with the latest smoke-tinted styrene dust cover. The unit is ready for mains operation complete with pickup leads and phono plugs. No wiring, no soldering, no waiting. Just plug in for BSR perfection.

BSR

BSR (A'Asia) Pty. Ltd. Southern Section
Industrial Estate St. Marys New South Wales 2760
Telephone 623.0375 and 623.0376

Wholesale Distributors **Goldring Engineering (A'asia) Pty Ltd**

☐ **New South Wales** 26 Ricketty Street Mascot 2020 Telephone 67 6088 ☐ **Victoria** 162 Pelham Street Carlton 3053 Telephone 34 5105
☐ **Queensland** 415 Adelaide Street Brisbane 4000 Telephone 2 3247 ☐ **Western Australia** 32 Northwood Street Leederville 6007 Telephone 84 988
☐ **South Australia** 77 Wright Street Adelaide 5000 Telephone 23 3488 ☐ **New Zealand** C.P.O. Box 2630 Auckland

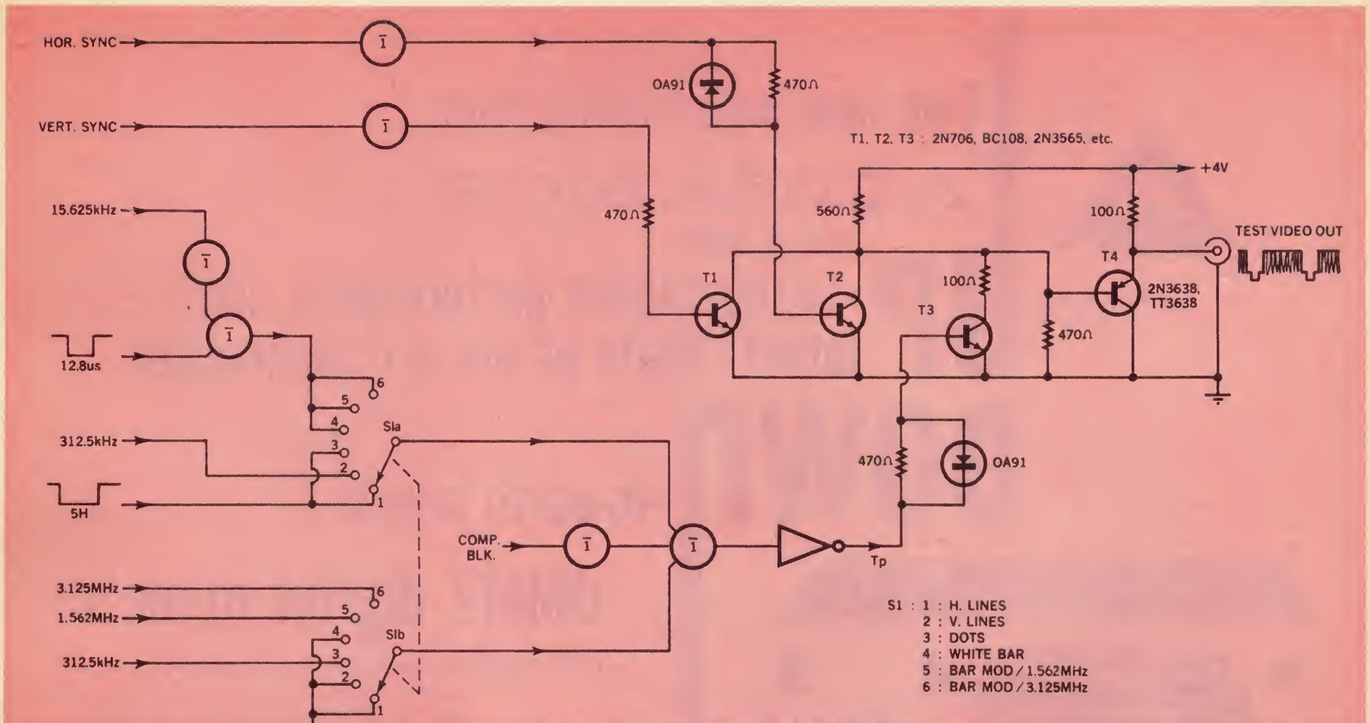


Fig. 6 TEST PATTERN LOGIC AND VIDEO SYNTHESIS

For all three of the remaining test patterns a vertical bar signal is derived from the 15.625kHz horizontal timing signal and another signal taken from the output of the second x10 divider stage, using a simple logic circuit. The bar signal is selected by Sla, and is used alone (by earthing the rotor of Slb) when the white bar pattern is required. To effectively modulate the bar for the other two patterns, Slb is used to select either a 1.562MHz or a 3.125MHz signal derived from the first x10 divider stage.

The composite blanking signal is used to gate the signals selected by Sla and Slb in order to ensure that the pulses which form the test pattern logic signal Tp occur only during the "active" portions of each scanning line and field interval.

The actual test pattern video signal is produced by the four-transistor discrete circuit section shown in Fig. 6. Basically this circuit consists of the PNP transistor T4 connected as an inverted emitter-follower, with its base fed by a resistive voltage divider connected across the 4V supply lines. The top part of the divider is the 560 ohm resistor; superficially the lower part is the 470 ohm resistor, but in fact this is shunted by the switching transistors T1, T2 and T3, the last with a 100 ohm resistor in series. The video signal is generated by the switching action of these transistors as they change the effective resistance in the lower part of the voltage divider.

Transistors T1 and T2 are fed with inverted vertical and horizontal sync pulses, so that they saturate during the sync intervals. During the sync intervals one or the other of the transistors therefore effectively shorts out the 470 ohm divider resistor at the base of T4, reducing the base voltage to almost zero. During the sync pulse intervals the output from the emitter of T4 is therefore very low — approximately 0.6V.

Between sync pulses, T1 and T2 are normally cut off, so that if it were not for T3 the voltage at the base of T4 would rise to approximately half the supply voltage. However the test pattern logic signal Tp keeps T3 saturated for at least the duration of the composite blanking pulses, and this means that the 100 ohm resistor in series with T3 is effectively connected in parallel with the 470 ohm divider resistor.

This means that at least during the blanking intervals the voltage in the base of T4 can only rise to about +0.5V. While T3 is driven into conduction by the Tp signal, then, T4 delivers the "setup level" of the video level, at about 1.1V.

The "white" level of the video signal is produced whenever the Tp logic signal removes the forward bias on transistor T3. With T1, T2 and T3 all cut off, the voltage on the base of T4 thus rises to approximately half the supply voltage, so that T4 delivers a white level output of approximately 2.1V.

(Continued on page 129)

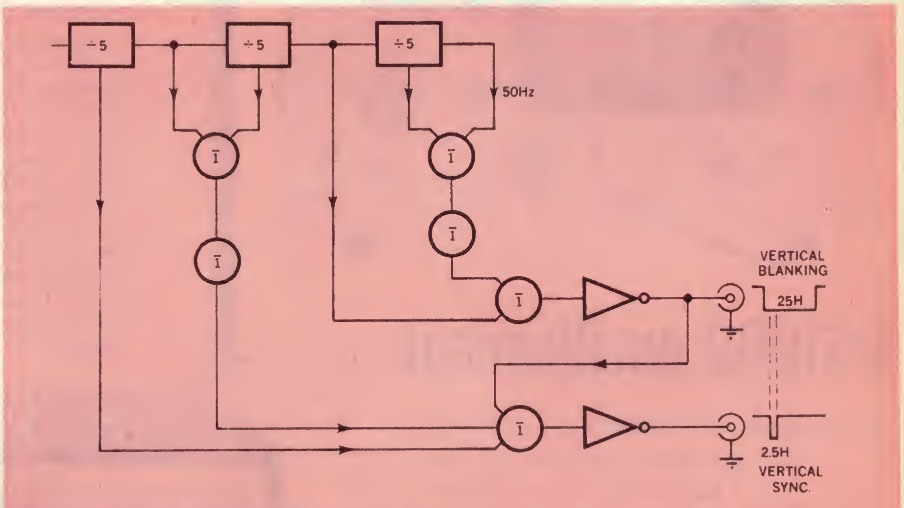


Fig. 4 SYNTHESIS OF VERT. BLANKING AND SYNC. PULSES

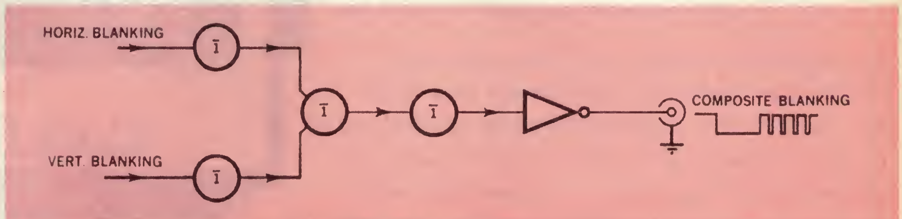


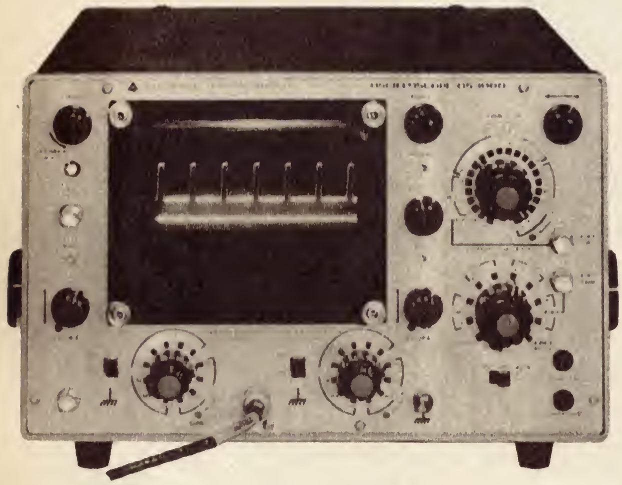
Fig. 5 COMPOSITE BLANKING LOGIC

Two new instruments from ADVANCE

which offer

UP -to-the-minute performance and latest 'state of the art' technology

DOWN -to-earth prices



OS1000 oscilloscope

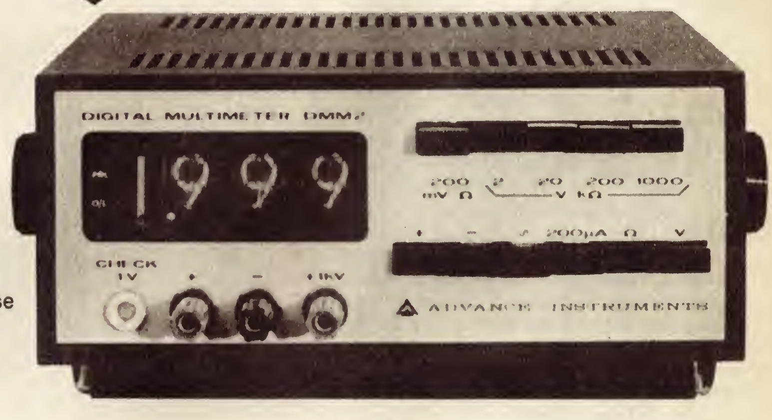
OUTSTANDING FEATURES • DC to 15 MHz bandwidth • 5mV/cm dual trace • Signal delay • Comprehensive trigger facilities, incl. TV sync. • Bright line auto free-run • Switched X-Y operation

The ADVANCE OS1000 is a portable, dual trace oscilloscope, combining small size and light weight with a specification providing the ability to make precise waveform measurements. Wide time base ranges and comprehensive trigger control combined with broad bandwidth and calibrated deflection factor make this instrument suitable for many general purpose and laboratory and TV applications. Use of solid state circuitry throughout makes the OS1000 particularly suitable for servicing or laboratory use.
Full specifications available on request.

DMM2 digital m/meter

OUTSTANDING FEATURES • 17 ranges for measurement of AC or DC voltage, current and resistance • Maximum stability • LSI reliability

The DMM2 Digital Multimeter provides in 17 ranges a clear digital reading of AC or DC voltage, AC and DC current and resistance. Push button selection of functions and ranges. The display has a max. reading of 1999 with automatically positioned decimal point. Overrange and reverse polarity indications are provided. The DMM2 weighs only 3½ lb and can be operated from AC supply, external 12V DC, or an optional rechargeable battery pack. Design ensures maximum stability for all measurements, ease of operation allowing use by non-technical operators and high reliability with all counting and storage functions performed by an LSI package (Large Scale Integrated Circuit). Full specifications available on request.



Distributed by:

JACOBY MITCHELL

SYDNEY	630 7400	PERTH	28 5725
MELBOURNE	41 7551	LAUNCESTON	2 5322
ADELAIDE	93 6117	WELLINGTON (N.Z.)	59 408
BRISBANE	44 4674	AUCKLAND (N.Z.)	490 144

JM/57/70

TAKE 20 COMPONENTS...

A group of simple transistor projects, each using less than 20 low-cost components.

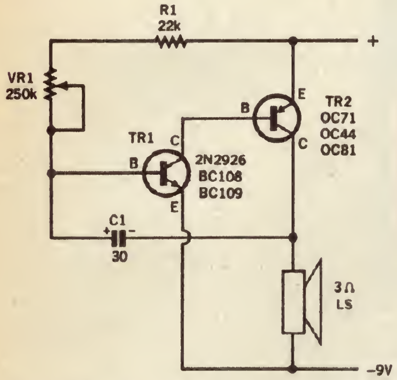
by JULIAN ANDERSON

A Mini Metronome

Here is a really simple project — a unit that simulates beautifully the sound of a time bomb ticking away! For those more attracted to gentler pastimes it may also serve as a metronome, that is it gives a loud click at regular intervals, the actual interval being varied by a potentiometer in the circuit. It's very simplicity also makes it highly suitable for use as an audio warning device, inserting the alarm switch in the supply line.

The actual working of the circuit is fairly simple; on applying a voltage across R1, VR1, C1 and the loudspeaker, the capacitor C1 charges up till a point is reached when Tr1 switches on, this in turn switches Tr2 to a conducting state — meaning that a voltage is applied across the loudspeaker causing it to "plop".

The base current of Tr1 neutralises the charge on C1 and soon the voltage on the base reaches the stage where the transistor



The circuit of the mini metronome.

is turned off; thus the cycle starts all over again. The rate at which C1 charges depends upon VR1 and thus by altering this the interval between each cycle can be varied.

The actual transistors used are unimportant, I have tried a large variety and all have worked successfully. One of the transistors is a PNP, the other NPN. The germanium one is similar to the OC71, OC44 etc, and the silicon one is like the BC108, BC109, 2N2926 etc.

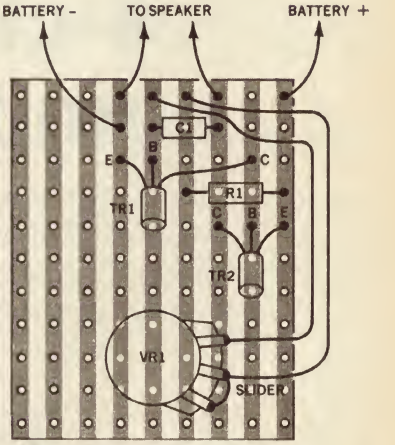
The components are mounted on a small piece of Veroboard. One end is drilled to take the potentiometer (⅜in spindles are virtually standard) and the other components are mounted and soldered at the other end. The project is so simple that very little can go wrong and immediately you switch on regular "plops" will be heard. By altering VR1 a wide range of intervals should be covered but if you want slower ones — that is with several seconds' interval, increase the value of C1. If you want faster ones lower its value.

The circuit described is certainly the cheapest method of getting a sound from a loudspeaker and thus it makes an ideal warning device. The plops themselves are loud and the unit could be used as a burglar alarm by arranging the supply voltage to be switched on when a window is opened etc. Even if the plopping isn't heard by anyone you can bet it'll get your unwelcome visitor worried.

The time intervals are regular and the unit will serve well for its intended use as a metronome providing the beat for music lessons etc.

Metronome Parts List

R1 22k, 10%, ¼W
C1 30uF 12V
VR1 250k lin pot
Tr1 2N2926, see text
Tr2 OC81, see text
Loudspeaker any 3-ohm or 8-ohm type
Veroboard 1¾ x 1⅜in, 0.15in matrix
9V battery



The component layout of the mini metronome using Veroboard.

A One-Transistor Radio

Ever since I first started playing about with transistors, I wanted to build a one-transistor radio, operating a loudspeaker without an external aerial. This was not possible in those early days as there were no transistors on the market with sufficient gain. A few months ago I had a crack at this again using the very high gain silicon transistors now available quite cheaply. The result is published here.

I don't want to mislead anyone, the volume is low but it is sufficient for a child's or bedside radio.

With the prices of nearly all components falling — and transistors falling most rapidly, many readers will think that it would be cheaper and easier to use two transistors and do away with some of the other parts. They are perfectly correct, but until there are laws forbidding slavery in transistors there is a lot of satisfaction in getting the last ounce of work out of them.

The signal is picked up on the aerial winding L1 on the ferrite rod and tuned by VC1. L2 transforms the signal and feeds it to the base of the transistor, C1 acting as a DC blocking capacitor. The amplified RF signal appears at the collector and finding its path blocked by the inductance of T1, passes through C2. Now C2 and L3 are chosen so that they form a tuned circuit, which is slightly damped by the other parts of the circuit, and it encourages the RF through it. The diode D1 detects this signal and after being smoothed by C1 passes to the base of Tr1.

The amplified AF signal appears at the collector and T1 acts as the load, transforms it and feeds it to the speaker. C2 is too low in value to pass much AF but any that does is taken straight to the earthy side of the circuit by L3. R1 provides the bias for the transistor and will vary with the one chosen; it is best found by experiment but will probably lie between 47k and 1M.

Almost any broadcast-band ferrite rod aerial may be used but the larger the better. If you want to wind your own, the aerial winding should consist of about 70 turns and the secondary, wound either beside or on top, of about 7 turns. Any transistor output transformer will suffice for T1, most of these are centre tapped but this should be ignored. L3 is the primary of an IF tansformer; take off the can protecting this and cut off the small capacitor if one is fitted; in this case the centre tap and secondary are ignored.

The larger the loudspeaker the better and although sufficient volume is obtained with a 2in speaker, the larger ones are far better. A volume control, if needed, is best fitted across the secondary of the output transformer — a 10-ohm pot should do. If this were fitted into any other part of the circuit it would affect the working conditions.

Care must be taken in the layout. Owing

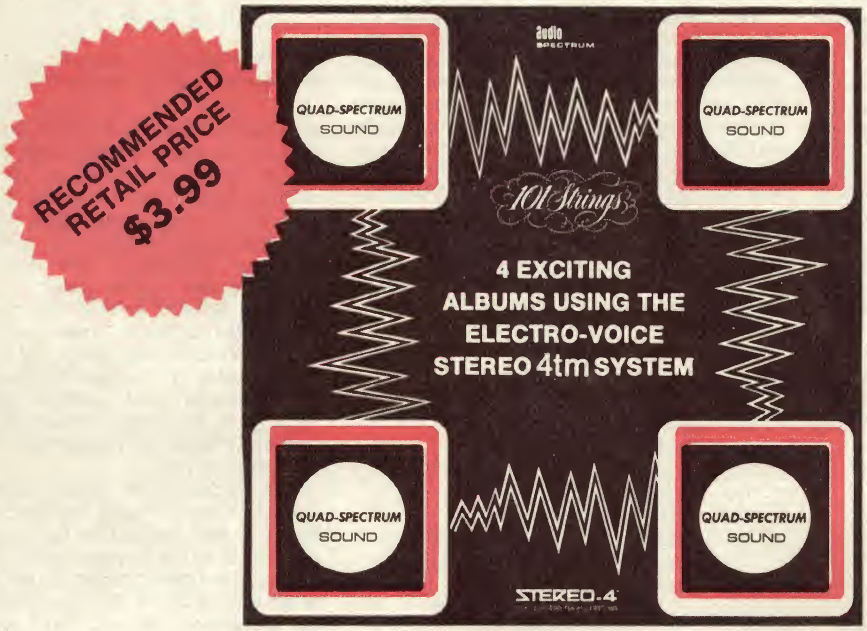
Reproduced from "Practical Wireless", by arrangement.

FIRST IN AUSTRALIA

QUAD-SPECTRUM SOUND

4-channel music on compatible 12" albums

For the first time in Australia, QUAD-SPECTRUM recording can be heard. The revolutionary new electro-voice stereo 4tm system contains four independent musical channels, which give tremendous impact as well as hi-fidelity stereophonic reproduction.



QUAD-SPECTRUM records are compatible and can be used on standard stereo equipment producing full fidelity 2-channel stereo without damage to 4-channel information.

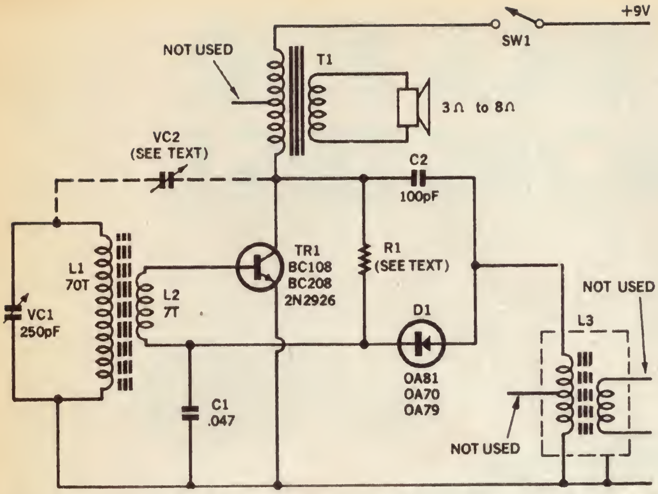
FIRST FOUR RELEASES:

- **QS/1. The Soul of Spain**
- **QS/2. Exciting Sounds of Les Baxter**
- **QS/3. Multiple Guitars of Les Thatcher**
- **QS/4. Today's Hits by Jack Dorsey**

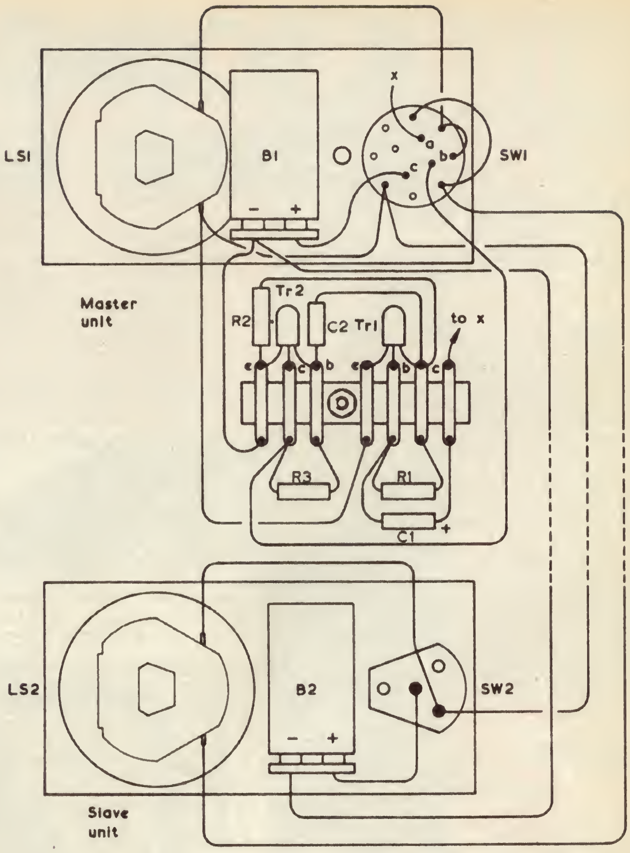
AUDIO SPECTRUM ON . . .

ASTOR

3160



(Above) The circuit of the simple one transistor radio.



(Right) Component layout and wiring details of the simple intercom.

to the very high gain it is easy for the circuit to break into oscillation and L3 must be kept well away from L1. Similarly L2 and the collector of Tr1 must be away from the aerial coil. This explains VC2; regeneration can be applied by feeding a tiny part of the signal back to the aerial coil, but the value of such a capacitor will be in the order of 0.5pF and its value is critical. It is best to keep the two apart as much as possible and then with a wire fixed to Tr1 collector to lay this near the winding. If the radio fails to oscillate reverse the connections of L2. If Veroboard is used even the capacitance between the strips may send it into uncontrolled oscillation.

After switching on, adjust the core in L3 for best results over the section of the band you will normally be using.

The current consumption is between 4mA and 15mA and a battery should last a fair while under these conditions.

Parts for One-Transistor Radio

R1 — see text
C1 0.047uF
C2 100pF
VC1 250pF variable
VC2 — see text
Tr1 2N2926 or similar
D1 OA70, OA79, OA81 etc
T1 Transistor output transformer
L3 IF transformer
Ferrite rod with MW winding
9V battery,
Loudspeaker
Paxolin board

Simple Intercom

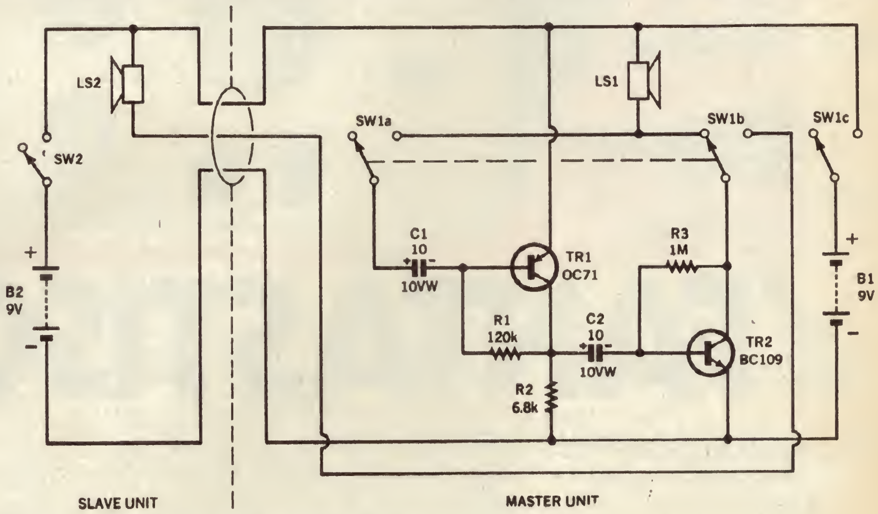
There are on the market several types of intercom, and there is no doubt that many readers could find a use for one, but doubt whether the expenditure would be justified. The unit described here is a relatively low-cost project. It can easily be used as a baby alarm — it is certainly sensitive enough — merely by switching one of the units on permanently.

Most of the commercially available units are arranged so that first a signal button is pressed and the unit is then switched on and the volume level set. Also nearly all of them can be used for "spying", that is, switching on by the master activates the slave microphone so that the master can eavesdrop.

The unit described here is not fitted with a buzzer as calling over the unit is usually enough to draw the attention of the distant party. It cannot be used for eavesdropping (an undesirable, "Big Brother" type feature) and thus its installation can cause no offence. Since no volume control is fitted (this is really unnecessary for this type of equipment) only one switch is operated by either end to activate the unit.

The basis of the intercom is a simple amplifier which boosts the "microphone" output to feed a speaker. To make the project simpler and cheaper we use balanced armature earpieces which, by being switched, serve both functions as microphone and loudspeaker. These balanced armature earpieces are really marvellous pieces of design. They are extremely sensitive, have a perfect impedance for transformerless transistor work and are very cheap. Some are still available from various sources, but this will not help those who can't obtain them. Eight-ohm loudspeakers can be used in their place, even if a little more expensive.

The amplifier is slightly unusual and is a very simple Lo-Fi (I imagine that's the



The circuit diagram of the simple intercom.

A SOUND IDEA FOR SOUND ENGINEERS!

b.w.d AND COMMUNICATION & VIDEO ENGINEERS TOO!

THE BWD **506** embodies some unique features together with an excellent performance that makes it an outstanding instrument.

Its isolated ground enables 'in circuit' measurement to be made up to 400V from ground and eliminates ground loops and noise from low level measurements.

The active TV Sync. circuit provides immediate line or frame lock fast enough to see the individual frame pulses, colour bursts and equalising pulses. The circuit also provides an HF reject trigger selector and a demodulator for stable displays of amplitude modulated RF Waveforms. **• BAND WIDTH DC to 15MHz. 5mV to 20V/CM. • 40nSEC to 10SEC/CM SWEEP RANGE. • 1Hz to 15MHz AUTO TRIGGERING, BRIGHT BASE LINE AT ALL T.B. SPEEDS. • 8 x 10 CM RECTANGULAR DISPLAY. • 3KV EHT 5% CALIBRATION. • 100% SOLID STATE I.C. AMPLIFIER.**

$304
F.I.S. AUSTRALIA

WINNER OF AWARD FOR OUTSTANDING EXPORT ACHIEVEMENT

'FANTASTISCOPE'

ONLY ONE IN THE RANGE OF BWD EXPORT AWARD INSTRUMENTATION.

BWD ELECTRONICS PTY. LTD.

DESIGNERS & MANUFACTURERS OF THE FINEST ELECTRONIC INSTRUMENTATION

329-333 Burke Rd., Gardiner, Vic 3146. Ph 25 4425. 127 Blues Point Rd., Nth. Syd, N.S.W. 2060. Ph 929 7452
SOUTH AUST: A. J. Ferguson Pty. Ltd. Ph 51 6895. WEST AUST: Cairns Instrument Services. Ph 23 3871
QLD: Warburton Franki (Bris.) Pty. Ltd. Ph 51 5121. NEW ZEALAND: P. H. Rothschild, Lower Hutt. Ph 6 3581

GL&C 335BW

Parts for Simple Intercom

R1 120k ¼W miniature
R2 6.8k ¼W miniature
R3 1M ¼W miniature
C1, C2 10uF 10V
Tr1 OC71 or similar
Tr2 BC109C or similar
SW1 three-pole, two-way
SW2 one-pole, two-way
LS1, LS2 balanced armature earpieces
Miscellaneous:
Paxolin boards, tagstrip battery clips.

opposite of Hi-Fi!) sensitive AF amplifier. It uses a PNP and an NPN transistor and is RC coupled. The switching is straightforward; two batteries are used, one each in the master and slave section. This is done purely to enable a three-wire rather than a four-wire connector to be used.

In the normal position (as shown in the circuit diagram) no current is drawn and the switch on the master is set to receive calls from the slave. The only thing the slave has to do is apply battery voltage to the master by making SW2.

When the master makes a call the output from the amplifier is fed to the slave loudspeaker, its own loudspeaker is switched to the input, becoming the microphone and the slave's microphone becomes the loudspeaker switched to the output of the amplifier. The master unit will, of course, override the slave.

Both the sections are built on Paxolin panels about 4¼ x 2½in and all the components, including the battery, are mounted on this; the layout is by no means critical and the drawing is self-explanatory.

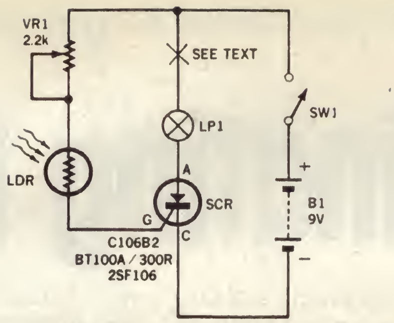
Although it may be better if press button switches were used, these are not readily available and are rather dear compared with the rotary switches used here. Also, using rotary switches enables either of these units to be switched on permanently for use as a baby alarm.

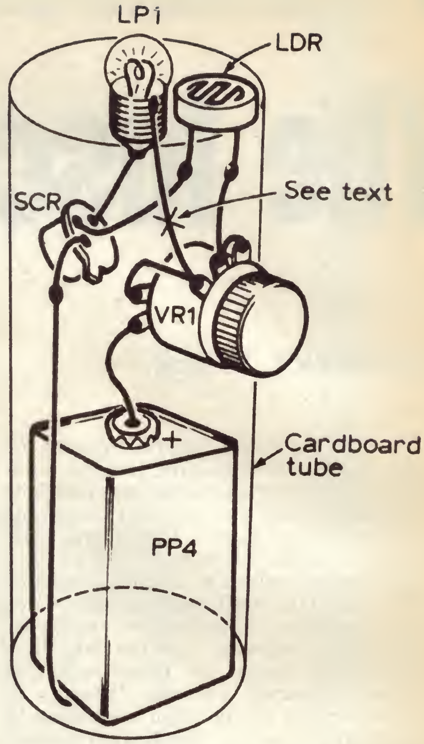
Magic Candle

Part of the fun of electronics is in being able to "amaze and mystify" members of the family and friends with little tricks. Those unfamiliar with the mysteries of electronics invariably assume that anyone who has tackled even the simplest crystal set is a true genius and, even when they see how few parts are employed, refuse to believe that "that's all there is to it". When they can't see the components that make an item tick they are even more impressed — let us not shatter their illusions, let us allow the uninitiated to marvel at our unquestionable brilliance!

This project is purely for fun; to my knowledge it has no practical use whatsoever but it should amuse and it is relatively inexpensive. Using the constructional layout shown none of the component leads need be cut short and this will allow the components to be employed later for some more practical purpose.

The title of magic candle is self explanatory: the wick and flame are replaced by a small light bulb; when a lighted match or cigarette lighter is moved near it the bulb lights up and remains alight until "snuffed" by turning it off.





The circuit of the magic candle (above). The components are mounted inside a cardboard tube (right), painted to look like a candle.

Apart from the battery, only four components are used: a light dependent resistor (LDR), a silicon-controlled rectifier (SCR), a potentiometer (VR1) and the bulb itself.

At normal light levels the resistance of the LDR will be several hundred ohms (though this varies enormously with the specimen and the actual light level) and with VR1 at maximum setting there will not be sufficient current flowing in the gate circuit to trigger the SCR. However, if VR1 is reduced in value and the light level on the LDR increases there will be an increase in current, the SCR will turn on and apply the battery volts across the bulb. Because of the action of an SCR even when the triggering current falls away completely, current will still be passed in the anode-cathode circuit.

VR1 acts as the sensitivity control; when it is set to minimum resistance and with a sensitive LDR, even quite low light levels will trigger the circuit. At maximum resistance the bulb will probably not light at all.

Ideally one would use both a battery and a bulb of the same voltage but SCRs don't seem to work well at voltages much below 9V and 9V bulbs with low current consumption are not widely available. If one can be obtained (note that the current should be no higher than 60mA) the circuit is exactly as shown. However 6V, 40mA

Magic Candle Parts List

VR1 2.2k lin. pot with switch
LDR Light dependent resistor
SCR C106 B2 or similar thyristor (50V, 1A)
LP1 6V, 40mA bulb, see text

bulbs are available and cheap but to avoid blowing it a 68-ohm resistor should be wired in series with the bulb at the point marked both in the circuit and the layout.

The circuit is best built to look something like a wax candle. A cardboard tube, such as aluminium foil is supplied on, is suitable. The battery sits on the bottom to give stability with VR1 just above this. For ease of wiring it is best to wire up VR1 first with three long leads, two to come out of the top and one that goes down to the battery and then to fit it into a hole cut out of the side.

A stout card disc, cut to go over the top, can then be fitted with the bulb and the LDR which should be lightly glued under a small hole about ¼in in diameter. This should be as near to the bulb as possible. The SCR can be either left floating as shown or it can be glued to the top cardboard disc. A long wire should be fitted to the cathode which is fed down the tube to the battery negative terminal. Once working the tube and top may be painted white to give the appearance of a candle.

A simple receiver is all you need to get started on

The fascinating DX hobby

by HARRY TYRER

The practice of DX (long distance) listening to radio broadcasts is a highly organised hobby in which most radio stations co-operate. Here we explain how to get started in DX, how to report to stations and the rewards to be expected.

The hobby of DXing has its origins in the early days of broadcasting, but in those days only a few broadcasting organisations transmitted material on short wave for overseas reception. Nowadays, the situation is quite different.

For various reasons nearly every country of any size in the world operates short wave radio services, intended for reception outside its national boundaries. The broadcasting bodies of these countries actively encourage overseas listeners to send in reports of reception conditions in their particular areas. This has the twofold purpose of estimating the penetration of their program material and of establishing the quality of reception in various parts of the world. They request their overseas listeners to send reports of reception, and in return they send a confirmation of reception in the form of a letter or "QSL card", sometimes accompanied by pennants, calendars, diaries and other mementos.

This practice of listening to overseas stations on short wave and obtaining confirmation of reception has developed into a hobby with world-wide following. The extent of the hobby may be judged by the existence of DX clubs, specialist magazines in some countries, and in our own magazine a monthly feature entitled "Listening Around The World."

In view of the close connection between DX reception and ionospheric conditions, many DXers have acquired a secondary interest in the study of the ionosphere which can be every bit as absorbing as the main hobby. Some DX clubs obtain information on sunspot activity for the benefit of their members.

The range of frequencies available to long range broadcasters is limited by two factors, known respectively as the maximum usable frequency (MUF) which determines the upper limit and the absorption limiting frequency (ALF), which fixes the lowest usable frequency for short wave broadcasting. Both these factors vary according to ionospheric conditions — for example, in periods of high sunspot activity, the MUF goes higher — but in general the changes in the ALF are not significant enough to warrant special attention on the part of international broadcasters. However, station engineers pay close attention to variations in the MUF, and as the maximum occurs in the 11-year sunspot cycles, many stations move up into the higher frequencies which become available for use at this time, since these frequencies are relatively uncluttered and propagation close to the MUF is more efficient.

At one time, the choice of frequencies by international broadcasters tended to be haphazard, with several stations broadcasting on the same or overlapping frequencies, causing mutual interference to the disadvantage of all concerned. In more recent years, there has been widespread acceptance of a plan drawn up by the International Radio Frequency Board (IRFB) of the International Telecommunication Union (ITU).

This requires every short wave station of signatory countries to register in advance with the IRFB its planned transmission schedule and frequencies to be employed. The IRFB then points out any instances where interference is likely to be experienced, and suggests alternative arrangements which offer minimum inconvenience to all parties. Four times a year there is a major reshuffle of frequency allocation to allow the best use of available frequencies according to seasonal conditions in the different parts of the world. The changes come into effect on the first Sundays of March, May, September and November. Interference on short waves is now very much less than formerly.

While most DXers carry out the major part of their listening on short wave, many find pleasure in DX reception of stations operating in the broadcast bands on medium wave. The range of frequencies in the broadcast band cover 530KHz to 1600KHz. On these frequencies, reception over long distances is possible only when the transmission path is in darkness, after the D and E layers of the ionosphere have virtually disappeared. Reception is still possible when either the transmitting or receiving end of the transmission path is in the half light of dawn or dusk.

Signals across the Tasman are the easiest to receive by DXers in Australia and New Zealand, being at good level from dusk to station close down. After 1400, Asian signals

A selection from the thousands of verification cards received from every continent by our short-wave correspondent Arthur Cushen. TOP OF FACING PAGE: Arthur Cushen at his listening post. In the past 35 years he has verified 2000 medium-wave stations and some 3800 short-wave stations, from 228 countries.

are present, being best received in the winter months and at the equinoctial periods of March and September. European signals are also best received during the equinoctial periods, the most favourable time being our dawn. Our DX correspondent Art Cushen has confirmed reception of 1900 stations operating in the broadcast band, of which 1100 stations are in North America alone, and 110 stations in Europe.

In this part of the world, the best reception period for signals from North and South America are from 0700 to 0900GMT and 1100 to 1400GMT. American stations usually begin operating at 6am local time, which is 1100GMT in the Eastern States, 1200GMT in the Central States, 1300GMT in the Mountains and 1400GMT on the Pacific Coast. Stations in Hawaii begin at 1600GMT.

The unpredictable nature of reception on medium wave is one of the fascinations of this aspect of the DX hobby. One may spend many hours listening to faint signals, subject to fading and severe interference, then unaccountably stations come flooding in at good signal level.

Since medium-wave signals are not intended to be received over long distances, there is a special interest in logging these signals, and reports of reception are specially appreciated by the stations concerned.

The question is sometimes posed, especially by younger readers, "How do I get started in DXing?"

One of the principal attractions of DXing is that it requires no technical knowledge, no special licence, and the equipment can be very simple — in the very simplest case, only an ordinary domestic receiver with a short wave band is sufficient to make a start. As interest develops, a better receiver designed specifically for short-wave will probably be sought by the keen hobbyist. In the practice of his hobby, the DXer will in the course of time acquire some knowledge of some of the technicalities involved. He should certainly seek to understand the meaning of such terms as kilohertz (KHz) and megahertz (MHz), Greenwich Mean Time (GMT), ionosphere, sunspot activity, and fading.

While listening sessions can be nothing more than random dial turning the dedicated DXer will want to work to a method. As with most other hobbies, more pleasure can be extracted by working systematically. The following hints have been provided by our DX correspondent, Arthur Cushen, author of our monthly feature "Listening Around the World," who

SUNSPOTS AND THE IONOSPHERE

An understanding of the effects of ionospheric changes on long distance radio reception, and what factors operate to bring about such changes, is useful knowledge for the DX listener.

The ionosphere completely surrounds our planet, and consists of layers of ionised gases. It has been established that these gases (mainly oxygen, nitrogen and the rarer gases which make up our atmosphere) are ionised by radiation from the sun.

Ionisation occurs when atoms become electrically charged, either through a deficiency in their normal quota of electrons (positive ions) or a surplus of electrons (negative ions). In the case of the ionosphere, ions are formed by radiation from the sun (principally from ultra-violet and X-rays). The number of ions formed, and consequently the thickness of the ionospheric layers, at any point in the atmosphere dependes on the degree of radiation received at that point.

Figure 1 shows the formation of the ionosphere typical for summer and winter daylight and night-time conditions. It will be noted that during daylight hours there are four main layers: the D layer, which extends from about 30 miles to 50 miles above the surface of the earth; the E layer, extending from 50 to 90 miles; the F1 layer, which begins slightly above the E layer and extends to about 150 miles; and the F2 layer, the upper limit of which varies from around 200 miles to 300 miles, according to season.

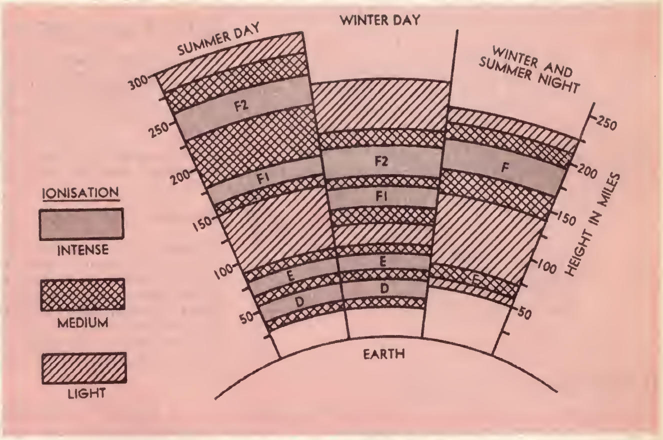


FIGURE 1. This diagram shows the daily and seasonal variations in the ionosphere. Note that at night the D layer disappears, the E layer becomes much smaller, and the F1 and F2 layers merge and become indistinguishable from one another.

All the layers of the ionosphere go through a daily cycle, reaching maximum intensity around noon (the different layers reach their maximum ionisation at slightly different times) but whereas the D and E layers virtually disappear during the hours of darkness, because of recombination of the electrons, the F layers persist from sunset to dawn. Were it not for this fact, radio communication except over line-of-sight paths with any region in darkness would be impossible.

The amount of radiation received by the ionosphere from the sun varies continually, as the result of various natural phenomena, such as the elliptical orbit of the earth around the sun, which results in the earth being about three million miles nearer to the sun during our summer; the rotation of the earth on its axis, which results in the daily cycle of change already described; irregular events, such as solar eclipses; and the 11-year sunspot cycle.

The changes in the number of sunspots has a dramatic effect on the ionosphere. Current theories suggest that the disturbances on the surface of the sun which give rise to sunspots cause the formation of ions on a massive scale, and that vast numbers of liberated electrons shoot across space to bombard our ionosphere. The resulting formation of ionised particles in the upper ionosphere makes it possible to obtain better reflection of radio waves at higher frequencies than normal. For this reason, international short wave broadcasters make much greater use of the higher frequencies in the 13 and 16 metre bands during periods of high sunspot count.

On the other hand, during sunspot minimum periods, the short wave frequencies in the lower 31, 41 and 49 metres bands become greatly overcrowded as short wave broadcasters all over the world are forced to abandon the higher frequencies.

In long-range radio communication, the radio waves travel around the world in a series of skips, reflecting successively from the ionosphere and the surface of the earth. Were it not for the ability of the ionosphere to act as a reflector in this way, the radio waves which impinge on it would simply travel out into space, and radio communication around the earth would be impossible without the aid of man-made reflectors.

As a radio wave skips back and forth between the ionosphere and the earth it becomes attenuated (weakened) in the process. Signals reflected by the lower D and E layers quickly become attenuated to the point where they cannot be received beyond a limited service area. The higher frequencies used by short wave broadcasters can penetrate the D and E layers and reflect from the F layer, but they become attenuated in the process. For this reason, signals travelling via the "path of darkness" are received at better signal level, since the D and E layers do not exist on the night side of the earth.

DRAKE — *The all purpose receiver*

DSR-1: Specifications

Frequency Range 10 kHz to 30.0 MHz.
Modes of Operation USB, LSB, CW, RTTY, AM, ISB.
Frequency Readout Complete to 100 Hz on six NIXIE tubes.
Frequency Selection 10 MHz, 1 MHz, 0.1 MHz switch selected. 0 to 0.1 MHz continuously variable.
Frequency Stability Drift does not exceed 150 Hz in any 15 minute period with a temperature change of 7°C per hour over a range of 0 to 40°C.
Sensitivity Less than 0.5 microvolt for 10 dB SINAD at 2.4 kHz SSB mode. Less than 1.0 microvolt for 10 dB SINAD at 6 Khz AM mode.
Image Rejection Greater than 70dB relative to 1 microvolt.
Blocking Greater than 100 dB relative to 1 microvolt.
Cross Modulation Greater than 90 dB relative to 1 microvolt.
Intermodulation Greater than 80 dB relative to 1 microvolt.
Opposite Sideband Suppression Greater than 60 dB at 500 Hz into the opposite sideband.
I.F. Bandwidth Selectivity

	—6 dB	—60 dB
6 khz	6 kHz	11.5 kHz
2.4 kHz	2.4 kHz	4.3 kHz
1.2 kHz	1.2 kHz	2.4 kHz
0.4 kHz	0.4 kHz	0.8 kHz

Optional filters available for other bandwidths.
I.F. Outputs 50 millivolts into 50 ohms at 1st I.F. 5.05 MHz and 2nd I.F. 50 kHz.
Automatic Gain Control Audio Output rises less than 3 dB for RF input change of 1 microvolt to 100 millivolts. Attack time: 100 microseconds. Release time: 750 milliseconds (Slow AGC) Release time: 25 milliseconds (Fast AGC)
Antenna Input Impedance 10kHz to 500kHz 1000 ohms. 500kHz to 30MHz 50 ohms.
Audio Output 3 watts at 5% maximum distortion into 3.2 ohm load. 1 volt into 600 ohm output line. 3.2 ohm unbalanced and two 600 ohm balanced outputs. ISB output is one of the two 600 ohm balanced outputs.
Audio Hum and Noise Greater than 60 dB below rated output.
BFO Derived from standard clock or variable over a ± 3 kHz range from front panel.
Power Requirements 115/ 230 volts ± 10% single phase 50-420 Hz 15 watts. 12 or 24 VDC supply optional.
Dimensions 5.25 in. H x 19 in. W x 15 in. D. (13.3 cm H x 48 cm W x 38 cm D)
Weight 17lbs. (7.7kg)

SPR-4: Specifications

Frequency Coverage: Can be programmed with accessory crystals for 23 ranges (each tuning a 500 kHz band) from .5 to 30 MHz plus 150 to 500 kHz. Crystals supplied with the receiver allow coverage on these ranges; 150-500kHz, .5-1.0 MHz, 1.0-1.6 MHz, 6.0-6.5 MHz*, 7.0-7.5 MHz, 9.5-10 MHz, 11.5-12 MHz, 15-15.5 MHz, 17.5-18 MHz, 21.5-22 MHz.
Modes of Operation: AM, CW, SSB (upper and lower)
Selectivity: AM —4.8 kHz at 6 dB, 10kHz at 60 dB SSB —2.4 kHz at 6 dB, 7.2 kHz at 60 dB CW — .4 kHz at 6 dB, 2.7 kHz at 60 dB
Intermediate Frequencies: 1st IF 5645 kHz four pole crystal lattice filter, 2nd IF 50kHz four pole Hi-Q Ferrite LC filter.
Frequency Stability: At room temperature, drift for all causes (including ±10% change in supply voltage) is less than ±100 Hz.

Sensitivity: SSB and CW: .25 microvolt gives 10 dB $\frac{S+N}{N}$, AM: .5 microvolt with 30% Mod gives 10 dB $\frac{S+N}{N}$.

Automatic Volume Control: AVC is used on AM, CW, and SSB. Time constants are selected for the optimum effectiveness on each mode. Audio output is held constant to 6 dB over a 100 dB range of input signals.
Input Impedance: 50 ohms approximately (higher impedance 150 kHz to 1500 kHz)
Output Power: 3 watts into 4 ohm load (less into higher impedance loads)
Power Consumption: 18 watts on 120 VAC or 5¾ watts on 12 VDC, 2.5 watts on 12 VDC with dial lights turned off.
Calibration: Dial is accurate to better than ±1 kHz when calibrated at nearest 100 kHz calibration point.
Hum and Noise: More than 60 dB below rated output.
Size and Weight: 5½" H. x 10¾" W. x 12¼" D. Weight: 18 pounds.

R-4B: Specifications

FREQUENCY COVERAGE: 3.5-4.0 MHz, 7.0-7.5 MHz, 14.0-14.5 MHz, 21.0-21.5 MHz and 28.5-29.0 MHz with crystals supplied. Ten accessory crystal sockets are provided for coverage of any 10 additional 500 KHz ranges between 1.5 and 30 MHz with the exception of 5.0-6.0 MHz.
SELECTIVITY: Drake tunable passband filter provides: 0.4 KHz at 6dB down and 2.6 KHz at 60dB down, 1.2 KHz at 6 dB down and 4.8 KHz at 60 dB down. 2.4 KHz at 6 dB down and 8.2 KHz at 60dB down, 4.8 KHz at 6 dB down and 25 KHz at 60 dB down.
Selectivity switching is independent of detector and AVC switching.
I.F. FREQUENCIES: First I.F., 5645 KHz crystal lattice filter; second I.F., 50 KHz tunable L/ C filter.
STABILITY: Less than 100 cycles after warm up. Less than 100 cycles for 10% line voltage change.
SENSITIVITY: Less than 0.25 uv for 10 dB signal plus noise to noise on all amateur bands.
MODES OF OPERATION: SSB, CW, AM, RTTY.
DIAL CALIBRATION: Main dial calibrated 0 to 500 KHz and 500 to 1000 KHz in 25 KHz divisions. Vernier dial calibrated 0 to 25 KHz in 1 KHz divisions. **CALIBRATION ACCURACY:** Better than 1 KHz when calibrated at nearest 100 KHz point.
AVC: Amplified delayed AVC having slow (.75 sec.) or fast (.025 sec.) discharge; less than 100 microsecond charge. AVC can also be switched off. 3 dB change in AF output with 60 dB change in RF input.
AUDIO OUTPUT: 1.5 Watts max. and .5 watts at AVC threshold.
AUDIO OUTPUT IMPEDANCE: 4 Ohms and hi impedance for anti-vox.
ANTENNA INPUT: Nominal 52 Ohms.
SPURIOUS RESPONSES: Image rejection more than 60 dB. I.F. rejection more than 60 dB on ham ranges. Internal spurious responses in ham ranges less than the equivalent 1 uv signal on the antenna.
CONTROLS AND JACKS:
Front: Main tuning, AF gain, RF gain, AM—SSB/ CW with slow AVC, fast AVC, or AVC off, function switch, band switch, xtal switch, passband tuning and selectivity, preselector, and notch.
Rear: Antenna jack, speaker jack, mute jack, anti-vox jack, injection jack, accessory power socket, and fuse post.
Side: Notch adjust, S-meter zero, VFO-Xtal switch, and headphone jack.
POWER CONSUMPTION: 60 watts. 120/ 240 VAC, 50 to 400 cycles.
DIMENSIONS: 5½" high, 10¾" wide, cabinet depth 11⅜", overall length 12¼", weight 16 lbs.

ELMEASCO INSTRUMENTS PTY LTD

PO BOX 334, Brookvale, NSW 2100. Phone 93 7944. Melbourne Phone 26 1552. Adelaide Phone 64 3296. Brisbane Phone 71 3366.

is recognised internationally as one of the world's leading DXers.

Start at the extreme end of the tuning range of the receiver (unless you are looking for specific stations) and tune slowly through the bands. Short wave stations are generally spaced 5KHz apart, or even less, so extreme care is required in tuning, especially when using a receiver without bandspread tuning.

International short-wave broadcast stations operate in the 49, 41, 31, 25, 19, 16, 13 and 11 metre bands, all of which fall within the frequency range 5950 to 26,100KHz. In addition, the 120, 90, 75 and 60 metre bands are used in some tropical areas for low power broadcasts intended for local reception. Accordingly, for coverage of all short-wave as well as medium-wave stations, the receiver should be tunable over the range 520-26,100KHz.

Most serious DXers recognise that some form of outside aerial is essential for good reception and to minimise the effects of interference. Many different types of aerial are suitable in a general sense, but the best choice for any particular location will depend on the amount of space available in which to erect it. The BBC, Bush House, London and Radio Nederland, PO Box 222, Hilversum, Holland, both have available free of charge excellent pamphlets which describe various aerials for short-wave reception.

In those cases where limited outdoor space prevents the erection of an outdoor aerial, many DXers are using loop aerials.

One of the advantages of DXing as a hobby is that it can be conducted on the scale which suits the individual. Some people are content to limit their activities to simply listening on short wave. Others regularly send reception reports to stations in all parts of the world and keep collections of the QSL cards these stations send in reply; take part in competitions organised by some station to promote DXing; join DX clubs; and keep in touch with world-wide DX developments by reading the magazines which cater for DX activities.

Before sending reception reports, the beginner should at least understand the information required by the stations, and the reason why such information is sought.

When preparing a reception report, it is essential to prove to the station that you did actually hear their broadcast. If you wish the report to be verified, it is necessary to include a brief description of at least 15 minutes of program heard, so that the station can check this against their log.

When sending a report, make sure that you give your full name and address, the date and time of reception (international stations prefer this to be shown in GMT), the frequency of the transmission, and details of reception conditions, using the SINPO code. A panel giving details of the SINPO code is published elsewhere in this article.

It is also necessary to provide details of your receiver, and the type of aerial used. If possible, give some comparison with signals from other stations broadcasting to your area.

Any interference experienced should be reported, as short-wave stations like to know what other stations are causing interference to their transmissions, whether on the same frequency, or on the channel above or below their frequency.

THE SINPO CODE

The SINPO code is a convenient way of summarising the various aspects of the signal quality in the following manner.

S (Signal)	*I (Interference)*	*N (Noise)*	*P (Propagation disturbance)*	*O (Overall merit)*
5 excellent *4 good* *3 fair* *2 poor* *1 barely audible*	*5 nil* *4 slight* *3 moderate* *2 severe* *1 extreme*	*5 nil* *4 slight* *3 moderate* *2 severe* *1 extreme*	*5 nil* *4 slight* *3 moderate* *2 severe* *1 extreme*	*5 excellent* *4 good* *3 fair* *2 poor* *1 unusable*

Information about interference is valuable to stations to enable them to secure for their use the most suitable frequency for broadcasting to certain areas. Listeners can therefore assist in ensuring that the best signal is transmitted to their areas by co-operating with stations in this matter.

DX clubs are operating in Australia and New Zealand, and interested readers should get in touch with the following:

Australian Radio DX Club,
PO Box 227, Box Hill,
Victoria, 3128.

New Zealand Radio DX League,
212 Earn Street, Invercargill.

Most DX clubs have special printed forms for the use of their members which contain all the entries necessary for a report, and it is only necessary for the listener to fill in the reception details.

The beginner is advised to locate only those stations broadcasting English language programs to begin with (or programs in his native tongue, if this is not English). When a station has been properly tuned, note its frequency on the tuning dial. Since tuning dials are seldom 100 per cent accurate, try to stay tuned until a station announcement, when station identification and call sign will be given. A list of stations with call signs and frequencies is a useful thing to have at hand, since these usually give information on the location of the transmitter, power and station address. The "World Radio and TV Handbook" is possibly the best-known publication containing this information. This is published annually, and is available through technical booksellers. Although such a book can never be completely up to date it does contain a great deal of useful information for the DXer.

To avoid ambiguity when expressing time, it is universal practice in short-wave broadcasting to give all times in Greenwich Mean Time (GMT). This international way of expressing time is based on the 24-hour clock, with the reference point taken as the Royal Observatory at Greenwich, London. With the 24-hour clock, time is expressed in four digits; thus 0001 is one minute after midnight; 0100 is one hour after midnight, 0200 is two hours after midnight, 0220 is two hours and 20 minutes after midnight and so on. Midday is 1200, and 1300 is one hour after midday. 2359 is one minute before midnight and of course 2400 is midnight, although some authorities prefer to show this time as 0000. All these times are understood to be taken at Greenwich, the reference point.

Eastern Australian Standard Time (EAST) is ten hours ahead of GMT so that 1200GMT is 10pm in Sydney and the other places on EAST. South Australia is 9½ hours ahead, and Western Australia 8 hours. When daylight saving is in operation, the time must be reduced by one hour on GMT. e.g.; EAST will be only nine hours ahead of GMT.

A bugbear which besets DXers is fading. This takes various forms, and may be slow or fast, regular or irregular, shallow or deep. The non-regular type of fading is a common occurrence on most short-wave broadcasts. The fast, or flutter, type of fading is experienced in the auroral zone during periods of auroral disturbance, and is caused by unstable conditions in the ionosphere.

Earlier, the ionosphere has been called a "radio mirror" and just as a glass mirror will not give a true reflection if the surface is distorted, so distortions of the ionosphere will cause non-uniform reflections, giving rise to distortions. The ionosphere is never stable, and it is the changing conditions which give rise to fading.

Fading is one of the conditions which should be reported to stations in reception reports. When using the SINPO code, it should be noted under the heading "Propagation Disturbance." The difficulty for short-wave listeners is to determine the extent of fading. Some sets have a "magic eye" tuning indicator which allows the degree of fading to be estimated, but a far better device is an "S-meter" (signal strength meter) which is often incorporated in receivers designed specifically for short wave.

Since the terms "frequency" and "wavelength" continue to be used more or less indiscriminately, it is desirable that the DXer should have a clear idea of the interrelationship between the two.

Beginners to DXing are sometimes puzzled by the seemingly haphazard use of these terms and although they usually grasp that there is some connection, many do not understand the relationship.

Briefly, the frequency at which a transmitter operates and the wavelength of the signals produced are interdependent, and are related by the following formula.

$$L = \frac{V}{F}$$

where L is the wavelength in metres; V is the velocity of the radio waves (usually taken as 3×10^8 metres a second); and F is the frequency in Hz.

Thus, we find that Radio Singapore operates on a frequency of 6000KHz (6,000,000Hz) so the wavelength is

$$\frac{3 \times 10^8}{6 \times 10^6} = 50 \text{ metres}$$

In the early days of broadcasting, it was not uncommon to say that a station was working a wavelength of so many metres, but this practice is now largely obsolete and the operating frequency is used instead.

DIRECTORY OF DX RECEIVERS

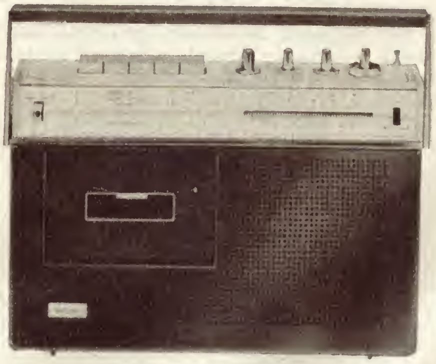
A Guide to Currently Available Models with Abbreviated Data

The information provided in the following list is published as a general guide to performance and is not intended for direct comparison. Readers are advised to check the manufacturers' literature for more detailed specifications of any receivers which interest them. Receivers marked with an asterisk (*) are available in rack-mounted versions for professional use. Prices indicated are recommended maximum retail selling prices and may or may not include sales tax.

PHILIPS 90 RL 297
Circuitry: 7 transistors.
Power: 6V internal batteries.
Coverage: 525-1605kHz and 2.2-23MHz in 2 bands.
Modes: AM.
Features: Provision for external power supply. In-built telescopic aerial.
Price: $59.
Distributor: Philips Industries Ltd, GPO Box 2703, Sydney, 2001.

PHILIPS 22 RL 497.
Circuitry: 7 transistors.
Power: 9V internal batteries.
Coverage: 525kHz to 22MHz (less 3.9-4.6MHz) in 4 bands.
Modes: AM.
Features: Connection for AC mains supply unit. In-built ferrite rod and frame aerials. Electrical fine tuning on higher 2 bands.
Price: $132.
Distributor: Philips Industries Ltd, GPO Box 2703, Sydney, 2001.

PHILIPS 22RR 415
Circuitry: 15 transistors.
Power: AC mains or 6V internal batteries.
Coverage: 525-1605kHz, 2.1-6.6MHz, 7-18MHz.



Modes: AM.
Features: In-built cassette recorder (4.75cm / s, 2 tracks).
Ferrite rod and telescopic aerials.
Price: $139.
Distributor: Philips Industries Ltd, GPO Box 2703, Sydney, 2001.

LAFAYETTE "Guardian 6000"
Circuitry: Not quoted.
Power: AC mains or internal batteries.
Coverage: 160-390kHz, 540-1600kHz, 1.6-4.6MHz plus 3 VHF FM bands.
Modes: Not quoted.
Features: Not quoted.
Price: $179.50.
Distributor: Lafayette Electronics, 94 High Street, St Kilda, Vic 3182.

LAFAYETTE "Guardian 7000"
Circuitry: Not quoted.
Power: AC mains or internal batteries.
Coverage: 540-1600kHz, 4.0-12.0MHz plus 3 VHF FM and 1 UHF FM bands.
Modes: Not quoted.
Features: Not quoted.
Price: $189.50.
Distributor: Lafayette Electronics, 94 High Street, St Kilda, Vic 3182.

TRIO 9R59DS
Circuitry: 6 valves.
Power: AC mains.
Coverage: 550kHz to 30MHz in 4 bands.
Modes: AM, CW and SSB.
Features: Bandspread all ranges, calibrated for amateur bands. Provision for voltage regulator valve. Crystal calibrator.
Price: $191.
Distributor: Weston Electronics Pty Ltd, 376 Eastern Valley Way, Roseville, NSW 2069.

EICO DX 718 "Space Ranger"
Circuitry: 9 transistors, inc FET front end.
Power: AC mains (105-125V) or 12V battery.
Coverage: 535kHz to 30MHz in 4 bands.
Modes: AM, CW and SSB.
Features: Bandspread tuning. Automatic noise limiter. Stand-by switch. Built-in ferrite rod antenna. Internal speaker.
Price: $189 plus sales tax.
Distributor: Elmeasco Instruments Pty Ltd, PO Box 334, Brookvale, NSW 2100.

LAFAYETTE HA-800B
Circuitry: Not quoted.
Power: AC mains or 12V battery.
Coverage: 6 amateur bands in range 3.5 to

50MHz.
Modes: Not quoted.
Features: 100kHz crystal calibrator optional.
Price: $215.
Distributor: Lafayette Electronics, 94 High Street, St Kilda, Vic 3182.

EDDYSTONE EC10 MkII
Circuitry: 10 transistors.
Power: 9V battery pack. AC supply optional extra.
Coverage: 550kHz to 30MHz in 5 bands.
Modes: CW and AM.
Features: Fine tuning. Integral carrier level meter. Audio filter for CW reception. A special marine version has LF range changed to 300 to 550kHz and includes a crystal controlled 2182kHz distress channel.
Price: $255 inc sales tax.
Distributor: R. H. Cunningham Pty Ltd, 608 Collins St, Melbourne, Vic 3000.

LAFAYETTE HA-600A
Circuitry: Not quoted.
Power: AC mains or 12V battery.
Coverage: 150 to 400kHz plus 0.55 to 30MHz in 4 bands.
Modes: Not quoted.
Features: Not quoted.
Price: $219.50.
Distributor: Lafayette Electronics, 94 High Street, St Kilda, Vic 3182.

REALISTIC DX150A
Circuitry: 16 transistors.
Power: AC mains or 12V battery.
Coverage: 535kHz to 30MHz in 4 bands.
Modes: CW, AM and SSB.
Features: Bandspread all ranges, calibrated for amateur bands. SSB product detector. Inbuilt monitor speaker.
Price: $234.20.
Distributor: Weston Electronics Pty Ltd, 376 Eastern Valley Way, Roseville, NSW 2069.

SONY CRF-160
Circuitry: 22 transistors, inc 2 FETs.
Power: AC mains or 9V internal batteries. 12V DC optional.
Coverage: 150-400kHz, 530-1605kHz, 10 SW bands in range 1.6-26.1MHz inc all popular DX frequencies, and 1 VHF FM band.
Modes: AM and FM.
Features: Double superhet all SW bands above 4.7MHz. Telescopic antenna (1.2m) for SW.
Price: $386.50.
Distributor: Jacoby Kempthorne Pty Ltd, 469 Kent Street, Sydney, 2000.

DRAKE SW-4A
Circuitry: 6 valves, 7 transistors.
Power: AC mains.
Coverage: 150-500kHz plus 10 500kHz bands between 0.5 and 26MHz.
Features: Crystal controlled oscillator. Crystal lattice filter. Dual conversion. S-meter.
Price: $390 plus sales tax.
Distributor: Elmeasco Instruments Pty Ltd, PO Box 334, Brookvale, NSW 2100.

DRAKE SPR-4
Circuitry: Transistor, inc FET front end.
Power: AC Mains (120V) or 12V battery.
Coverage: 150 to 500kHz plus nine 500kHz bands between 0.5 and 30MHz.
Modes: AM, CW and SSB.
Features: Crystal controlled oscillator. Crystal lattice filter. Tuneable notch filter. Built-in speaker.
Price: $520 plus sales tax.
Distributor: Elmeasco Instruments Pty Ltd, PO Box 334, Brookvale, NSW 2100.

DRAKE R-4B
Circuitry: 10 valves, 10 transistors, 2 ICs.
Power: AC mains.
Coverage: 3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5, 21.0 to 21.5 and 28.5 to 29.0MHz plus any 10 500kHz ranges between 1.5 and 30MHz.
Modes: AM, CW, SSB and FSK.
Features: Crystal oscillator and permeability tuned VFO. Crystal lattice filter. 25kHz calibrator.
Price: $615 plus sales tax.
Distributor: Elmeasco Instruments Pty Ltd, PO Box 334, Brookvale, NSW 2100.

SONY CRF-230B
Circuitry: 48 transistors, inc 3 FETs.
Power: AC mains or 9V internal batteries. 12V DC optional.
Coverage: 150-400kHz, 530-1605kHz, 19 SW bands in the range 1.6-29.8MHz inc all popular DX frequencies, and 2 VHF FM bands.
Modes: AM, CW and FM.

Features: Double superhet all SW bands above 2.0MHz. Telescopic aerial. Tuning meter. Noise limiter. Muting switch.
Price: $1157.
Distributor: Jacoby Kempthorne Pty Ltd, 469 Kent Street, Sydney, 2000.

LABTRONICS 21B
Circuitry: 20 transistors.
Power: AC mains or 12V battery.
Coverage: Up to nine channels in 3 to 30MHz range.
Modes: AM and CW.
Features: Time signal receiver. Crystal controlled dual conversion superhet. Variable threshold noise limiter. Built-in speaker. Automatic supply switching.
Price: Not quoted.
Distributor: Laboratory Electronics, 96 Osborne Road, Mitchelton, Qld 4053.

EDDYSTONE 1830
Circuitry: Transistors, inc FET / MOSFET front end.
Power: AC mains or 12V battery.
Coverage: 120kHz to 30MHz in 9 bands.
Modes: CW, AM and SSB.
Features: Double conversion above 1.5MHz. Incremental IF tuning. Selectivity adjustable to mode. Crystal filter for narrow-band CW reception. Noise limiter. 100kHz IF output.
Price: $1898.09 inc sales tax.
Distributor: R.H. Cunningham Pty Ltd, 608 Collins St, Melbourne, Vic 3000.

RACAL RA.17L
Circuitry: 23 valves.
Power: AC mains.
Coverage: 500kHz to 30MHz continuous.
Modes: AM and CW.
Features: Wadley loop drift-cancelling system. Electronic bandswitching. Triple frequency conversion. 100kHz crystal calibrator. 100kHz IF output.
Price: Not quoted.
Distributor: Racal Electronics Pty Ltd, 47 Talavera Road, North Ryde, NSW 2113.

*** RACAL RA.1217**
Circuitry: Transistor.
Power: AC mains or 21-27V DC (positive earth).
Coverage: 200kHz to 30MHz continuous.
Modes: AM, CW and SSB.
Features: Wadley loop drift-cancelling system. Electronic bandswitching. Triple frequency conversion. 100kHz crystal calibrator. IF output at 100kHz or 455kHz. In-line digital frequency display.
Price: Not quoted.
Distributor: Racal Electronics Pty Ltd, 47 Talavera Road, North Ryde, NSW 2113.

*** DRAKE DSR-1**
Circuitry: All solid state
Power: AC mains. 12 or 24V DC supply optional.
Coverage: 10kHz to 30MHz continuous.
Modes: AM, CW, SSB, ISB and FSK.
Features: Phase locked digital frequency synthesiser in 10, 1 and 0.1MHz steps. Digital frequency display to 100Hz. Series balanced gate noise blanker.
Price: $2325 plus sales tax.
Distributor: Elmeasco Instruments Pty Ltd, PO Box 334, Brookvale, NSW 2100.

*** EDDYSTONE EC958**
Circuitry: 41 transistors (inc 24 FETs), 10 ICs.
Power: AC mains or 12V battery (with external converter).
Coverage: 10kHz to 30MHz in 10 bands.
Modes: CW, AM and SSB. Optional FSK
Features: Provision for 100kHz step tuning above 1.6MHz. Triple conversion above 1.6MHz. Incremental IF tuning. Aerial circuit overload protection.
Price: $3868.68 inc sales tax.
Distributor: R. H. Cunningham Pty Ltd, 608 Collins St, Melbourne, Vic 3000.

*** RACAL RA.1218**
Circuitry: All solid-state inc ICs.
Power: AC mains.
Coverage: 1 to 30MHz. continuous.
Modes: AM, CW and SSB.
Features: Wadley loop drift-cancelling system. Electronic frequency display to 10Hz. Facilities for external synthesiser or other frequency control. Electronic bandswitching. Five IF selectivity positions.
Price: Not quoted.
Distributor: Racal Electronics Pty Ltd, 47 Talavera Road, North Ryde, NSW 2113.

*** RACAL RA.1220.**
Circuitry: All solid-state.
Power: AC mains.
Coverage: 1 to 30MHz continuous.
Modes: AM, CW and SSB.
Features: Wadley drift-cancelling sytem. Racalok frequency stabiliser. Electronic digital display to 1Hz. Electronic bandswitching. Five IF selectivities.
Price: Not quoted.
Distributor: Racal Electronics Pty Ltd, 47 Talavera Road, North Ryde, NSW 2113.

*** WATKINS-JOHNSON 373A-2**
Circuitry: Not quoted.
Power: Not quoted.
Coverage: 500kHz to 30MHz in 2 bands.
Modes: AM, FM and CW.
Features: Wide bandwidth receiver, suitable for RFI detection. Four IF bandwidths to 400kHz. X-Y outputs for recorder.
Price: Not quoted.
Distributor: Racal Electronics Pty Ltd, 47 Talavera Road, North Ryde, NSW 2113.

EVEREADY®

BATTERIES

Eveready® Nickel Cadmium.

When they run down, charge them up. The rechargeable batteries that stay the way they come. Completely sealed.

And available in a wide range of shapes and sizes to suit your particular power needs.

If you'd like to know more, clip the coupon and we'll send you a brochure.

EVEREADY BATTERIES Products of UNION CARBIDE ® 'Eveready' & 'Union Carbide' are registered Trade Marks.

To: **UNION CARBIDE AUSTRALIA LIMITED**
Sydney: Consumer Products Division, 167-187 Kent St. 2 0559.
Brisbane: 243-253 Edward St. 31 1391. **Melbourne:** 505 St. Kilda Rd. 26 1241, 26 2332.
Adelaide: 41-49 Currie St. 51 6099. **Perth:** 901 Hay St. 21 2926.

Name ______________________________

Address ______________________ Postcode __________

085.P.213

Microwaves for the radio amateur —1

The microwave region of the electromagnetic spectrum still offers almost boundless opportunities for the amateur radio enthusiast to contribute to the state of the art. This is the first of a short series of articles written in an attempt to stimulate more activity on the microwave amateur bands.

by DES CLIFT, VK2AHC*

As so often happens in radio communications, the disadvantages of one part of the spectrum can become advantages at another. In this country, the geographical disadvantage of having the capital cities separated by hundreds of miles, which certainly limits activity on 144 and 432MHz, becomes a decided advantage on the microwave bands. This is because a high proportion of the interested amateurs all live within the three or four small areas associated with these capital cities. Even more fortuitous is the fact that practically all these capital cities have reasonable (20-60 miles) line of sight paths available to the experimenter. The reverse of these two factors is generally true in both the UK and USA.

Most of the bands listed have been available since soon after the war. Activity has ebbed and flowed over the years and varies from highly organised mountain top expeditions in the USA to the pairs of single operator portable station activity which is the main subject of the article.

The complexity and availability of equipment has also varied greatly over the years as will be seen by a study of various articles on the subject. The writer feels that the acceptance of solid state techniques by the average amateur now so greatly reduces the problems associated with portable operation that there should be an upsurge in activity such as there has never been before.

The old perennial about there being no surplus equipment available or other parties interested, which is the amateur's usual excuse for non use of these particular allocations, is just not valid. The writer has purchased over the last three or four years, some excellent pieces of microwave test equipment and components, at costs comparable or even less than those prevailing in the UK before he emigrated here in 1965.

At least one technique, the polaplexer, developed by the amateurs in the USA in their 3300 MHz experiments, has been used commercially in the now widely used microwave surveying equipment. Home made equipment does work satisfactorily, although, as with all aspects of amateur work, life is made much easier with the help of a bit of test equipment. Contrary to popular belief, a knowledge of advanced mathematics and physics and the ability to solve Maxwell's equations is not, repeat not, a necessity!

Microwave is a very practical subject. It is unique in that the wavelengths involved are of the same order as the dimensions of the gear itself and this makes life easy in many ways. It is hoped that this article will provide the basic knowledge which will open the door to this most interesting aspect of amateur experimentation.

The remainder of this introductory chapter will be used to give the reader a resume of amateur activity on the various microwave bands. The bands will be treated in order, starting from that with the lowest frequency.

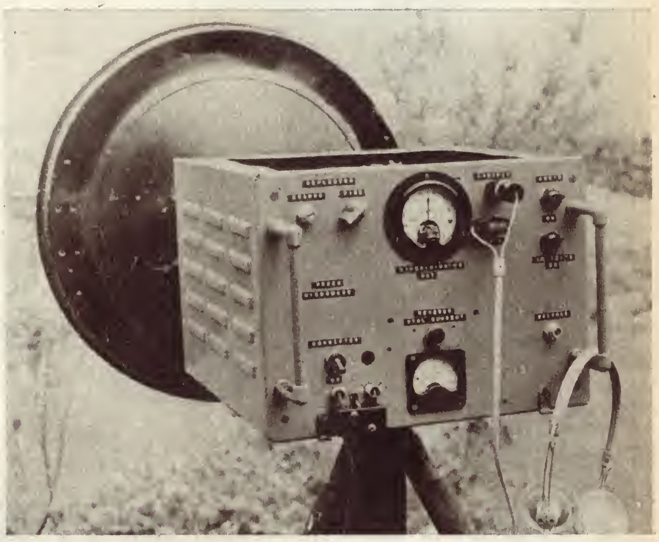
1215-1300 MHz

Almost universally, operation on this band is by crystal controlled transmitters and receivers, usually trebling from 432 MHz. Transmitters are either varactor treblers or 2C39 type treblers and straight amplifiers. Receivers are usually single or balanced crystal mixers, fed by a harmonically derived and filtered local oscillator. Operation is usually relay controlled simplex, but often with manual changeover, and a very convenient IF frequency can be 52 or 144 MHz.

Circuitry for the treblers and straight amplifiers can be made up conveniently from half-wave trough lines. Usually antenna are small and not very effective parabolas, corner reflectors, or even Yagi arrays. The August 1971 issue of the RSGB magazine "Radio Communication" gives details of a modern design for a 23cm Yagi; the writer's experience with a previous RSGB design (an 8 over 8 skeleton slot) was not very good. The 23cm band is really outside the scope of this series of articles, as conventional VHF / UHF techniques are mainly used.

2300-2450 MHz

Operation here is often by crystal controlled transmitters and receivers using similar techniques, but with more multipliers than 1215 MHz equipment. Such operation has tended to become standardised on 2304 MHz, the sixteenth harmonic of 144 MHz. Most amateur operators continue to use valves, and a number of surplus types, used in trough lines, or cylindrical cavities are suitable (DET22, DET29, 416B, 2C39A, etc) for the final stages of transmitters.



A prototype 10,000MHz system using circulator coupling. This is the equipment used by VK5CU in his experiments with VK5-ZMW reported in our September 1971 issue.

Harmonic mixing in single crystal mixers, followed by a low noise IF preamplifier, and again, a 52 or 144 MHz IF are the vogue for receiving. The smaller parabolas become more effective at this frequency and are the type of antennas used almost universally.

A number of UK amateurs have solved the multiplier chain problem in the receiver by using a self excited BFY90 transistor cavity oscillator on 2280 MHz (with an IF of 24 MHz) and injecting a marker signal of 2304 MHz at —40dBm derived from two 2N706's as 36 MHz crystal oscillator, and x4 multiplier, feeding a x16 multiplier using an AAZ112 diode in a home made cavity. Apparently the stability is good enough for use of the quite narrow band Heathkit Mohican as a tunable IF. This arrangement results in simplicity and lower power consumption. (Details "Radio Communication" August

* 6 Gilles Crescent, Dee Why, NSW 2099

1969, page 554, and November 1969, page 796).

Another UK group are using self excited pulsed 2C43 triodes in order to achieve high peak powers, and have succeeded in contacts in the region of 100 miles.

At present, therefore, this band really forms the crossroads between the world of conventional valves and transistors and their associated circuitry and that of the true microwave bands, where up to the present, the reflex klystron has been almost universally used.

3300-3500 MHz

This is the first of the microwave bands where full duplex operation usually takes place, and thus some form of standardisation of equipment is essential. The technique is as shown in figure 1; it is equally applicable to any of the bands under consideration but most used from 3300 MHz upward.

Station 1 has its transmitter operating on frequency 1. In practice this is usually provided by a small reflex klystron generating between 10 mW and 100 mW of power. A few milliwatts of this power is sampled in the coupling element and passed to a crystal mixer to act as the receiver local oscillator power. Here it combines with the received signal from Station 2, which has a similar transmitter whose frequency differs by the intermediate frequency (typically 30 MHz) from the frequency of the Station 1 transmitter. A similar IF frequency is also derived in Station 2. This arrangement, of course, necessitates that the two stations use the same IF frequency.

The advantages of this system are numerous and include:

1. Only one klystron is required per station.
2. No transmit / receive switching is necessary.
3. Tuning and antenna aligning can be done easily since a sidetone is produced from one's own modulator or tone whenever the carrier from the remote station is being received.

Practical arrangements using this technique vary with the band. In the 3300 MHz band, a system known as "polaplexing" has been widely used. In this system the two antennas of figure 1 are replaced by a single one, and the transmitted and received signals are arranged to be polarised at 90° with respect to one another and, therefore, electrically almost independent of each other. This constitutes the coupling element, of which the crystal mixer is an integral part, and as a result, the mechanics of the system are quite simple. Most of the 3300 MHz systems in use in the USA use this system and the polaplexer is often fabricated from soft drink cans. (Details in QST, June '63.)

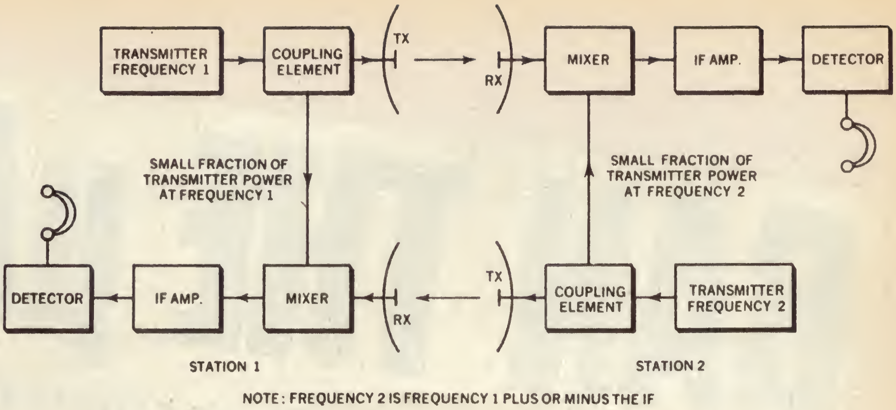


Fig. 1: The basic arrangement used for amateur microwave communications. Each transmitter also acts as the local oscillator for its receiver.

The table at right shows the various amateur microwave bands, together with the terminology used to describe them, and an indication of the activity to date.

Amateur Band Frequency Range (MHz)	Band †	Nominal Wavelength	Activity
1215- 1300	L	23cm	Low in Aust. Good in UK and USA.
2300- 2450	S	13cm	Low in Aust. Good in UK and USA.
3300- 3500	S	9cm	Low in Aust. Good in USA.
5650- 5850	C	6cm	Negligible world-wide.
10000-10500	X	3cm	Low in Aust. Good in UK.
21000-22000	K	1.5cm	Negligible world-wide.

† An unofficial, but generally accepted terminology relating to microwave allocations.

Note that the UK and USA allocations are basically the same as the Australian ones.

5650-5850 MHz

As shown in Table 1, there has been negligible activity in this band. This has been due to the virtual non-availability of surplus klystrons which operate at this frequency. It offers, therefore, a challenge to those prepared to experiment with the newer solid state devices.

Although the only set of 5650 MHz equipment produced by the writer used rectangular waveguide, it is now felt that this should be superseded by the polaplexing technique, as practically no test equipment, or for that matter, basic hardware, seems to have appeared on the surplus market. Nevertheless both the rectangular waveguide techniques as described in the 10,000 MHz section, following, and the polaplexing techniques of 3300 MHz are equally applicable. It is interesting to note here that basic coaxial techniques, hardly ever used by amateurs to date could well be investigated further for both 5650 and 3300 MHz.

Another view of the prototype 10,000 MHz system used by VK5CU, this time showing the parabolic aerial and feed system.

10,000-10,500MHz

This is the band among those under review which has probably attracted most interest by the amateur fraternity, particularly in the UK where activity has been excellent of late. The main reasons for this interest are:

(a) A large amount of surplus equipment from the widely used and adjacent frequency range of 8000-9750 MHz has been available, including a number of types of klystrons suitable for operation (after a simple modification) in the amateur allocation.

(b) This part of the spectrum became very

BAN THE μA776

Opposition mounts protest campaign against new Fairchild weapon in the IC War

Ban the μA776, a movement which started with the Fairchild introduction of this multipurpose, programmable, low cost op amp — see story.

A.P.P. Fri.: Increased tension and concern are reported from all opposition following Fairchild's successful introduction of the μA776 Multipurpose Programmable Operational Amplifier.

Latest reports indicate growing support among the enemy to have the μA776 totally banned. The enemy is particularly worried by the extreme versatility of the μA776, because users will be able to programme main parameters to suit their own particular requirements.

Further concern mounted when more was learned about the precise features of the μA776 op amp. With the addition of a simple external resistor, a user can select his own slew rate, frequency response, input bias current, input resistance, drift performance, open loop gain and a power supply range down to ±1.2V. The μA776 has all the features of an earlier Fairchild weapon — μA741 — plus 'programming capability'. It's also pin-for-pin compatible with the μA741.

Additional support for the Ban the μA776 movement has been gained since it was realised that Fairchild have included the μA776 in the LIC Selection Guide which fully describes all their general and specific-purpose op amps. When questioned by A.P.P., a Fairchild spokesman showed confident disregard for the Ban the μA776 campaign. He predicted total victory for the Fairchild μA776.

FOCUS

FURTHER developments in the Ban the μA776 campaign are expected following the growing realisation that the versatile μA776 has unprecedented economical factors. Cost is less than half the price one would normally expect to pay for a product with similar specifications. 'In particular, its low voltage operation is taking an unfair advantage,' a disgruntled rank-and-file protester said.

FAIRCHILD

AUSTRALIA PTY. LTD.

420 Mount Dandenong Road, Croydon, 3136

Melbourne 723 4131, Sydney 439 4355,
Adelaide 63 1435, Auckland N.Z., Otahuhu 6 9299

Distributors:
Melbourne: Radio Parts Group, 329 7888; J. H. Magrath & Co. Pty. Ltd., 663 3731.
Sydney: Geo. Brown & Co. Pty. Ltd., 29 7031; Dick Smith Manufacturing Co. (stockist), 43 1414; Martin de Launay Pty. Ltd. (stockist), 29 5834; General Accessories, 73 0211.
Canberra: Electronic Components Pty. Ltd., 95 6811.
Brisbane: Douglas Electronics Pty. Ltd., 97 8222.
Adelaide: General Accessories, 23 4022; Hills Electronics Telefix, 46 3832.
Auckland, N.Z.: John Gilbert & Co. Ltd., 3 0839.

Send coupon for the μA776 story and new LIC Selection Guide

Fairchild Australia Pty. Ltd.
420 Mt. Dandenong Road,
Croydon, Victoria, 3136

Please send me the new LIC Selection Guide

Name ____________________

Position ____________________

Company ____________________

Address ____________________

____

State ________ Postcode ____________

Phone No. ____________________

FC4406

familiar to amateurs connected with radar while in the services and it has been used almost exclusively for teaching microwave techniques at all levels.

(c) The size of the wave guide used is very convenient (as opposed to the very much larger and heavier sizes for use at 3300 MHz — a subject dealt with later in this discussion). Although surplus waveguide is the most convenient to work with, home-made waveguide tubing and components are reasonably easily made and work quite satisfactorily at this frequency.

(d) It offers a challenge to operate on as high a frequency as possible, and this frequency is probably the practical limit for the majority of amateurs.

(e) The antenna problem is not difficult, as home-made horn antennas with gains approaching those of small parabolas are easy to make and have known and repeatable characteristics.

The general modes of operation at 10,000 MHz are as previously described, with the addition of a few more which become practical because of the component availability and size. Three of these use a single antenna, but use different methods of obtaining the local oscillator and IF signals as shown in figures 2a, 2b, 2c, and 2d.

Probably the most efficient system the writer has used is shown in figure 2(d) and this and the circulator coupled system of 2(c) are the two in current use at VK5CU and described in detail in the later articles of this series.

ABOUT THE AUTHOR

Des Clift has been active on the microwave amateur bands for many years. In England he operated with the call sign G3BAK, until migrating to Australia in 1965. Until recently he was living in Hope Valley, S.A., where on 30th December 1971 in conjunction with Barry Wallis VK5ZMW he set a new 10,000MHz Australian record of 61 miles.

Although one or two UK amateurs have used the polaplexer principle at 10,000 MHz, and in fact it is used commercially at an even higher frequency, the writer prefers to keep to rectangular waveguide at this frequency because all of the associated equipment and test equipment is also in rectangular waveguides. Thus, there are less measurement and conversion (from polaplexer to test equipment) problems. Furthermore, the mechanical tolerances and complexity of the 10,000 MHz polaplexer do approach the limit of the average amateur facilities.

21,000-22,000 MHz

As with 5650 MHz the surplus market has yielded practically nothing for this band. Coupled with this is the fact that the mechanical engineering involved in the fabrication of components at this frequency is really outside the amateur field. What few reports of activity there have been over the years seem to have been concerned with amateurs professionally engaged in microwaves or microwave test equipment, who have had access to and borrowed commercial gear for the event.

All the techniques referred to for use at 10,000 MHz also tend to apply here. Klystrons do generally require higher voltages, which constitutes a problem for portable operation, and the generation of an appreciable amount of power at this frequency by the amateur using solid state devices is still, it is felt, quite a few years away. But, since the spirit of these articles is to solicit and encourage activity in all the amateur microwave bands, let us hope that some enthusiast in Australia will surmount all the problems and have a contact on 21,000 MHz.

(To be continued.)

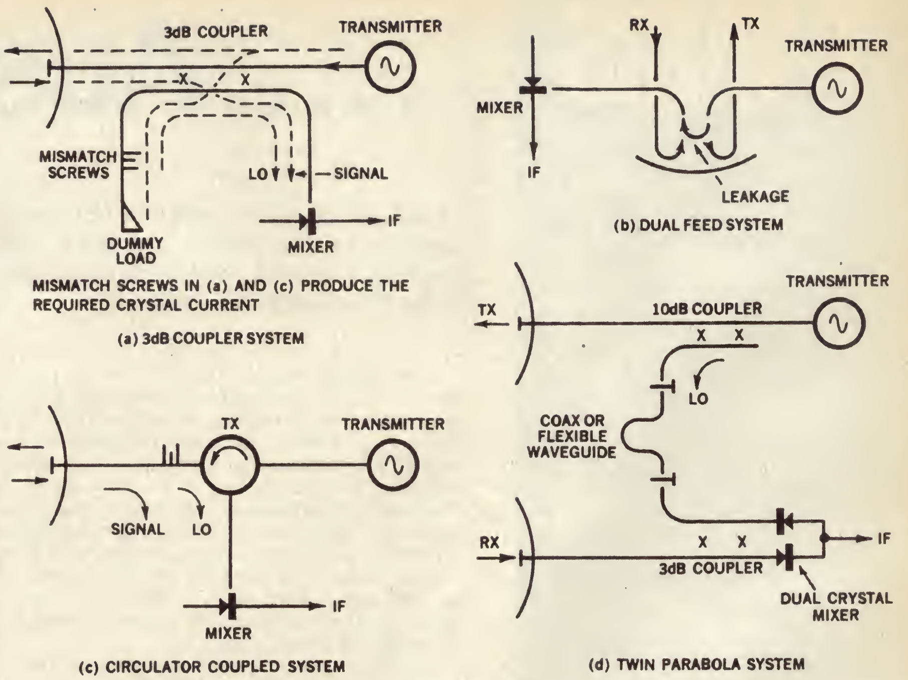
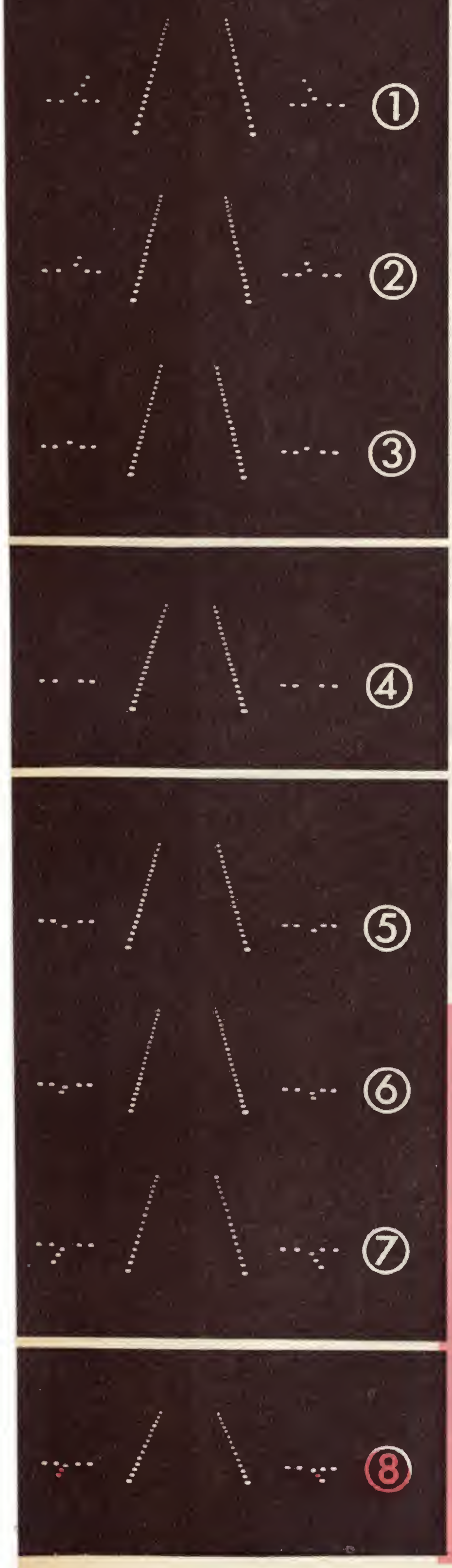


Fig. 2: The alternative systems used for amateur operation on 10,000MHz. Local oscillator coupling is achieved in (a) by a 3dB coupler, (b) by leakage between aerial feeds, (c) by a circulator, and (d) by twin couplers.

T-VASIS ..... Australia's

The Australian-designed T-VASIS aircraft landing aid, which was recently adopted as a world standard by the International Civil Aviation Organisation, has been further honoured by the award of the Prince Philip Prize for Australian design.



Two visual approach aids have so far received ICAO endorsement. The first was a British system called red-white VASIS; the second was the Australian system, for which T-VASIS is the internationally accepted abbreviation.

The abbreviation stems from the T-shaped patterns of light seen by a pilot approaching a runway. If his approach is too high, he will see the lights as an inverted "T"; if too low, he will see a normal "T". When his approach path is optimum, he will see merely a horizontal row of lights.

A system to provide this information has to operate in a variety of situations under changing ambient conditions, by day or night, and it has to be visible at four miles from the runway "threshold" (the line marking the beginning of the effective operational surface, before which the aircraft should not land).

The Department of Civil Aviation and the Aeronautical Research Laboratories of the Department of Supply began a long-term research study in the late 1950s, aimed at meeting these requirements with a high degree of accuracy. Several systems were subjected to evaluation and comparison. The result was T-VASIS. This system was developed from a concept originated by DCA and rigorously tested until it met all the requirements.

The system consists of two sets of light units, 10 on each side of the runway. Each set of 10 has a line of four light units (the "wing bar") at right angles to the centre line of the runway. The remaining six bisect the wing bar at right angles, three on each side of it. The pattern thus produced is in the form of a right-angled cross.

Each light unit is provided with a number of blades arranged at a critical angle, so that each light can be seen only over a narrow angle above the horizontal. (See figure 3.)

According to his height, the pilot of an approaching aircraft will see:

(1) a single horizontal line of lights, indicating that his approach path and height are right

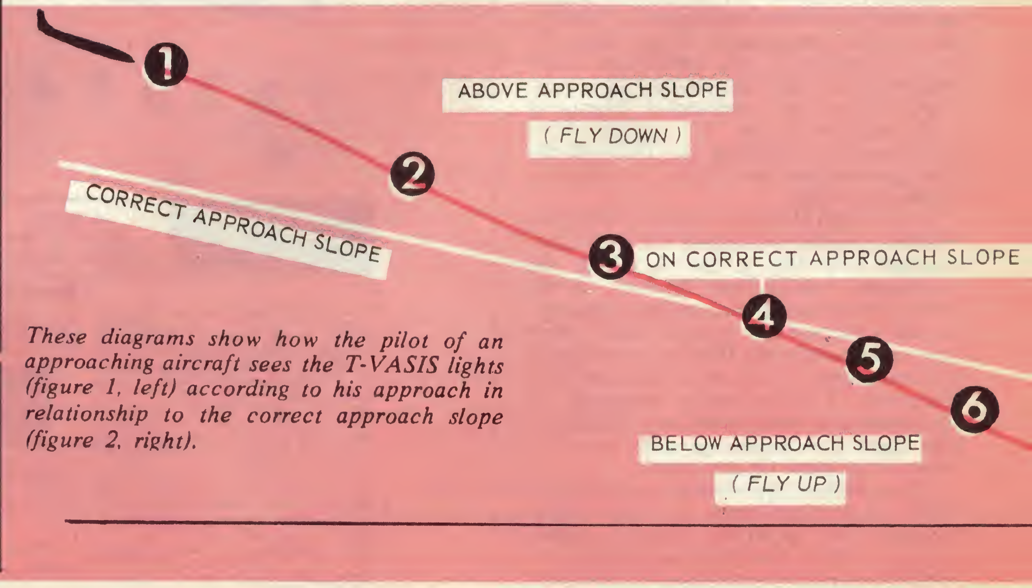
(2) an inverted "T", indicating that he is too high

(3) an upright "T", indicating that he is too low.

The lights forming the upright "T" also have red filters and blades arranged so that a pilot approaching in a gross undershoot condition will see a red upright "T". (See figure 1.)

The lights are positioned alongside the runway at a point where the flight path of an approaching aircraft at a height of 50ft above the runway threshold and descend-

This article is based on a text supplied by Mr. J. H. Leevers, BE, MIEAust, Principal Airport Lighting Engineer, Department of Civil Aviation.



These diagrams show how the pilot of an approaching aircraft sees the T-VASIS lights (figure 1, left) according to his approach in relationship to the correct approach slope (figure 2, right).

international landing aid

ing at a rate of 1 in 19, would, if produced in a straight line, intersect the runway. (See figure 2.)

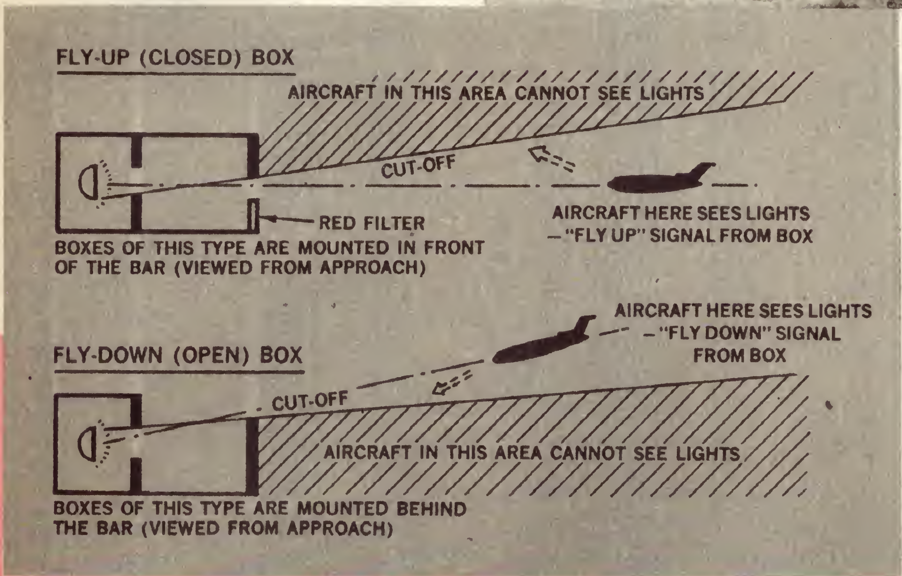
As will be seen from figure 1, the pilot is provided with an indication of the amount of undershoot or overshoot by the number of lights he can see forming the tail of the upright or inverted "T". For a slight degree of undershoot or overshoot, he will see only one light in the tail. Three lights in the tail indicate a considerable overshoot or undershoot. As previously mentioned, gross undershoot is indicated by a red upright "T".

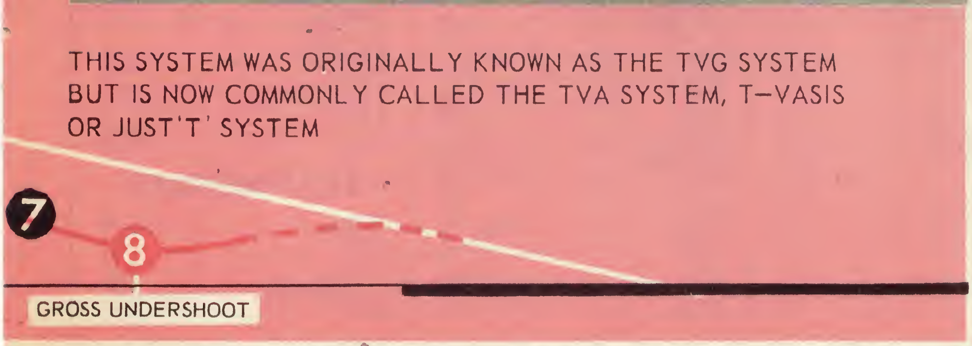
The system is sufficiently accurate to allow the safe operation of all present airline aircraft irrespective of size.

In the normal approach the system will guide the pilot's eye over the threshold at a height of about 50ft, thereby allowing adequate clearance of the aircraft wheels.

With larger aircraft, particularly those referred to as long bodied aircraft such as the Boeing 747, it is necessary for a pilot to fly higher than a normal slope. With this system it is considered quite satisfactory that the pilot fly the slope with between one and two lights indication of "fly down". This will result in the height of the pilot's eye at the threshold being increased to a height of approximately 70ft, which provides adequate clearance between the aircraft wheels and the threshold.

DCA personnel check the accuracy of alignment of a T-VASIS light unit at Melbourne airport with a special 6ft long spirit level.





It was the ability of the T-VASIS to provide suitable guidance for the Boeing 747 that helped persuade ICAO to adopt the system as an alternative world standard.

The T-VASIS light units are located well clear of the runway, the leg units of the T being 175ft from the centreline, with the nearest wing bar light unit normally 60ft from the runway edge.

To provide the required four mile range in Australian conditions it has been ascertained that a light intensity of 100,000 candela is required. This is obtained from a group of four sealed beam lamps situated on the rear of the light unit.

In order to cover the full range of ambient lighting conditions two sets of lamps, one for daylight and one for night use, together with different current levels, provide a six stage intensity system.

T-VASIS has been used at major Australian and NZ airports for a number of years. Since 1964, there have been 94 systems installed in the two countries.

The adoption of T-VASIS by ICAO is seen as an important step in world aviation safety. Anticipating the future use of the system on overseas airports, overseas companies are currently negotiating with DCA for licences to manufacture the equipment in their own countries.

ALL PRICES INCLUDE TAX AND POSTAGE

IMPORTED COMPONENTS

P.O. BOX 1683P, MELBOURNE 3001

SPECIALS

AC126	.85
AC187 / 188	2.00
AY1101	.28
AY1110	.99
AY1112	,51
AY1115	.46
BA100	.36
BC207	.59
BC209	.70
BF115	.78
EM402	.23
EM404	.26
EM406	.34
EM408	.42
OA90	.29
OA91	.30
OA95	.35
OA202	.60
ORP12	.75
SP1460	3.00
SE1001	.27
SE4002	.50
SE4010	.57
ST2	1.10
40669	3.10
2N3053	1.57
2N3055	1.30
2N3565	.42
2N3568	.67
2N3569	.71
2N3638	.57
2N3638A	.75
2N3642	.81
2N3644	.78
2N3645	.88
2N3693	.26
2N3819	.77
1N645	.84
1N914	.51
IN3491 + R	1.75
IN3492 + R	1.83
1N3493 + R	2.36
1N3660 + R	1.99

2N174	6.09
2N217	1.24
2N277	2.32
2N301	3.24
2N301A	4.68
2N406	1.01
2N417	1.77
2N441	1.80
2N443	3.22
2N456A	4.20
2N489B	14.76
2N591	2.61
2N649	2.12
2N696	1.13
2N697	2.34
2N706A	1.80
2N930	1.80
2N1038	3.92
2N1046	17.94
2N1073B	7.59
2N1302	1.01
2N1303	1.01
2N1305	1.13
2N1306	1.32
2N1307	1.32
2N1308	1.64
2N1309	1.64
2N1546	5.85
2N1639	1.39
2N1908	27.74
2N2102	3.51
2N2147	5.04
2N2160	2.40
2N2188	2.79
2N2270	2.40
2N2646	2.19
2N2647	3.15
2N2669	6.53
2N2926	2.25
2N3005	5.32
2N3054	1.80
2N3525	3.70
2N3563	.90
2N3564	1.08

2N3566	1.01
2N3567	1.08
2N3691	.86
2N3692	.90
2N3694	.90
2N3702	1.01
2N3703	.96
2N3704	1.77
2N3705	1.73
2N3706	1.65
2N3707	1.14
2N3708	.80
2N3716	5.30
2N3731	3.17
2N3790	11.25
2N4121	1.04
2N4250	1.17
2N4354	1.28
2N4355	1.65
2N4356	1.65
2SB186	1.50
2SB407	3.30
2SB474	3.30
2SF28	5.60
3N140	2.97
3N141	2.95
AA119	.36
AC107	2.28
AC125	.96
AC128	1.05
AC132	1.01
AC172	1.20
AD149	2.45
AD161 / 162	4.32
AN1102	.68
AN1103	.60
AN1104	.60
AN1105	.60
AN2001	.45
AN7102	.90
AN7105	.68
AS147	.80
AS148	.76
AS208	1.68
AS301	.91
AS306	.96
AS307	.96
AS308	.99
AS310	1.12
AS311	1.10
AS312	1.10
AS313	1.08
ASY73	1.66
ASY76	2.10
ASY77	1.80
AS216	3.03
AS217	2.59
AS218	2.91
AS220	.98
AS221	2.16
AT316	.68
AT318	.68
AT319	.69
AT322	.63
AT323	.68
AT324	.68
AT325	.83
AT331	.92
AT337	.69
AT338	.70
AT341	.70
AT350	1.14
AT1138	2.66
AX1101	1.53
AX1103	1.70
AX1104	1.86
AX1108	1.86
AX1127	1.50
AX1130	1.50
AX1131	1.77
AX1132	1.50
AX1142	1.20
AX1143	1.58
AX1144	1.44
AX1166	1.37
AX6168	1.98
AY1102	1.04
AY1108	1.65
AY1113	.69
AY1119	.60

AY6108	1.65
AY6109	1.65
AY8108(8103)	3.75
AY8109(8104)	3.00
AY8112	6.75
AY8135	5.40
BA102	1.46
BA114	.39
BC107	.83
BC108	.76
BC109	.91
BC147	.76
BC148	.68
BC149	.79
BC157	.89
BC158	.76
BC159	.89
BC177	.91
BC178	.84
BC179	.92
BC208	.63
BC212	2.00
BCY10	2.59
BCY11	3.24
BCY12	3.14
BCY39	5.19
BCY71	2.05
BCZ210	1.95
BCZ211	2.37
BCZ212	2.16
BD139	3.67
BD140	3.90
BDY20	2.63
BDY38+	2.62
BF145	.64
BF173	1.14
BF177	1.63
BF178	1.80
BF179	2.04
BF18	.72
BF185	.72
BF194	.67
BF200	1.32
BFY51	5.19
BSX19	2.16
BSX20	2.39
BT100A / 500R	3.00
BT101 / 500	5.40
BTY79 / 100R	2.70
BTY79 / 300R	3.45
BTY79 / 500R	5.19
BY127 / 800	.78
BYX21L / 200R	1.35
BYX38 / 300 + R	1.32
BYX38 / 600 + R	1.62
BYX38 / 900 + R	2.08
BYX38 / 1200 + R	3.03
BYX39 / 600 + R	3.14
BYX39 / 800 + R	3.88
BYX39 / 1000 + R	4.53
B2X70Scvies	1.35
B2Y88C303toC11	.65
B2Y88C12toC30	.82
BZY95 Scvies	2.16
BZY96 Scvies	2.16
BZZ15to29	1.95
C20D+	6.60
C106 / Y1	2.10
C122D	3.78
D13TI	1.95
DTG110B	6.96
DTG1010	15.16
EM410	1.40
FLV100	3.30
FPT100	1.80
H35	8.07
MB1	2.03
MB3	2.65
MB6	3.40
MB8	4.30
MJE2955	4.55
MJE3055	3.06
OA5	.65
OA10	.87
OA47	.65
OC20	6.38
OC22	3.03
OC23	3.80
OC24	3.45
OC44N	1.11

OC45N	1.11
OC74N	.96
OC141	2.60
OC201	3.80
OC202	3.70
OCP70	2.60
OCP71	4.32
ORP60	1.75
PA40	4.83
PB40	7.26
SC45D	11.10
SC50D	13.00
SE2001	.98
SE2002	1.20
SE3001	1.12
SE5001	2.10
SE5002	2.10
SE5003	2.48
SE5020	4.05
SE5023	3.15
SE5025	1.35
T1 / 40 / A2	3.30
T13027	2.61
TIC44	1.68
TIC45	1.88
TIC46	2.05
TIC47	2.30
TIP31A	2.10
TIP32A	2.70
TIP33A	2.98
TIS34	2.46
TIS43	2.36
40360	2.48
40361	2.70
40407	2.52
40408	2.98
40409	3.15
40410	3.30
40411	4.00

FETS

MPF102	1.00
MPF104	1.10
MPF105	1.50
MPF121	1.50
2N3820	4.55
2N4360	1.55
2N4889	2.50
2N5245	2.50
2N5485	1.50
2N5486	1.60

I.C.'S

uA703	2.25
uA709	1.50
uA710	1.65
uA716	5.60
uA723	3.80
uA739	5.00
uA741	2.25
FUL900	1.20
FUL914	1.10
FUL923	2.25
LM301A	2.25
LM305	7.27
LM309K	4.80
LM370	6.50
LM372	5.50
MC1303L	5.00
SN7400series	exstock P.O.A.
TAA300	4.30
TAA570	4.20
TAA840	5.40
TA10A	8.75
TA20	26.00
TA25	32.00
TA50	39.00

TRANSISTORS

BC182L	150
TT800	1.95
TT801	1.95
3N81	6.40
TIL209(LED)	2.40
40362	3.10

FORUM

Conducted by Neville Williams

Building your own colour TV receiver

Announcement of the starting date for colour television in Australia has triggered a number of inquiries from readers along the lines: "Are we going to be able to build our own colour television receivers — and save money? Are you going to run a constructional series? Why not start now so that the set will be finished and paid for by March 1975?"

To answer these questions, it is necessary to repeat in part what was said a few months back, but let's do it anyway.

Building your own receiver was all the rage around 1957-1960, following the introduction of television into Australia. Would-be constructors were motivated by the desire to learn something about television in a practical way and also by the then valid assumption that they would save money in the process.

No less important was the fact that, about the same time, a number of component manufacturers saw their chance to make some "gravy" by supplying the home constructor market, along with the many small manufacturers who seemed suddenly to materialise.

As a result, it was possible to buy from regular parts suppliers packaged and prealigned IF strips, matching and prealigned tuners, complete deflection kits, pre-punched chassis, tube hardware and all the other necessary bits and pieces, even down to matching sets of knobs.

No less important, it was possible to put the components together, literally on the kitchen table, to switch on, make a few adjustments and settle down with a finished set — without having gone within miles of an alignment set-up.

This facility came as a pleasant surprise after years of speculation as to whether home-constructed TV sets would ever be a proposition. I know, because I was involved in the speculation and I personally built that first 17-inch TV set in my own home situation.

But, unfortunately, what was a proposition in 1957 has ceased to be so in 1972.

The novelty of building one's own TV receiver has faded and the incentive of lower cost has been eroded or eliminated by competition between the major receiver manufacturers.

Small-time receiver manufacturers, whose needs more or less paralleled those of the home-builder, have long since disappeared from the scene.

As a result, firms manufacturing or importing for the particular market have either folded or turned their attentions elsewhere.

Consequently, anyone who might wish to build their own television receiver today (even monochrome) would have to collect parts held mainly as replacements for commercial receivers. They would have to contrive a circuit around whatever parts they managed to acquire, assemble their own IF channels, confirm the design, test and align using whatever test gear they could get their hands on.

Undoubtedly there must still be some activity along these lines — but not much. From all evidence, home constructors of TV receivers are very, very few and far between. There is virtually no demand and, equally, no systematic supply of components.

So to the question of colour sets.

Undoubtedly a certain number of engineers and technicians from receiver factories, TV stations and other such places will already have been collecting sample and oddment components that might one day become part of a complete color receiver.

However, it is one thing for an individual to build a colour receiver against a background of expertise and a lab. full of equipment. It is quite another to attempt the same job on a kitchen table, without such a background and using parts bought over the counter.

Right now in Australia — for all practical purposes — it couldn't be done. The parts are simply not there to be bought and the circuits are not there to be followed.

But what say we were to take a senior member of our staff off all other work for six to twelve months and put his time to the design and presentation of a complete colour receiver.

Would the parts position automatically be resolved?

Would manufacturers commit themselves to the production of the components and/or modules that constructors would ultimately require?

Would importers undertake to provide a continuing supply of those components which might not be available from local sources?

The answers would almost certainly be in the negative unless the firms concerned could see a substantial rejuvenation in home television construction and a parallel demand from a whole new crop of small-time colour TV set manufacturers.

So we face the old chicken-and-egg dilemma, with a twist:

What's the use of a design without the components?

What's the use of components without a design?

What's the use of either — or both — if the market isn't big enough to justify the investment?

You feel sure that the demand would be there? You may be absolutely right.

The real question is whether there are manufacturers or importers out there who share that opinion strongly enough to back a marketing venture.

It happened that way in 1957. There are, as yet, no significant portents relative to 1975.

Over this whole situation hangs another problem which must surely haunt anyone who addresses themselves to the design of a colour television receiver, whether for home construction or commercial release. I refer to the television industry's induction into the era of solid-state.

Up till a few years ago, a new model TV set could be approached basically as a variation on a theme. Most of the circuitry could be borrowed from the preceding model. Here and there a new valve would replace an older and less efficient type. The deflection and power supply configuration would be altered to suit, but the design problems were fairly well understood and fairly well under control.

After all, the industry had been making and using valves and the allied technology for fifty years and a few new type numbers really didn't change the situation.

But a few years ago, semiconductors literally forced themselves into the sights of TV set designers and the process of changing over to solid-state circuitry began. For the most part, it has been a fairly gradual operation, marked by quite a few hybrid receivers built around a mixture of valves, transistors and integrated circuits. Each new model has represented a further step towards completely solid-state design.

Unfortunately, the path has not been a smooth one. Introduce the subject in a service situation and one is almost certain to be regaled with stories of well-known brand name receivers which suffer from recurrent and unforeseen failures of this transistor or that transistor — for reasons that are by no means apparent.

There are stories of modifications to certain models, which have rendered the original circuit entirely meaningless and which have long since outstripped the modification notes.

A classic story concerns a receiver which "blows" line output transistors unless the waveforms are adjusted precisely to specification, under working conditions. The trouble is that it is likely to blow the replacement transistor before the technician has had time to optimise the waveform! (See "Serviceman" elsewhere.)

Even applying a discount to the grouches of the servicing industry, it is impossible to

escape the conviction that the electronics industry still has some lessons to learn about solid-state as applied to monochrome television receivers. And if this is true of monochrome, it will apply even more to colour with its greater complexity and more critical circuitry.

It is a pretty safe bet that Australian colour TV receivers will be all solid-state.

Nor is technology going to stand still during the next two or three years. It is virtually certain that more and more sections of colour receivers will be compressed into integrated circuit blocks. Inductors will tend to give place to resonant filters and perhaps obviate some of the present uncertainties of circuit alignment.

Picture tubes and deflection circuitry will come in for a lot of attention. To date, the shadow-mask tube has been the major display device but the Sony Trinitron has the potential to cause an upset in more ways than one.

In short, Australian receiver (and component) manufacturers are going to have to cope with a large platefull of problems within the next twelve or eighteen months:

- Sort out the lingering problems with solid-state technology;
- Expand the technology to take in the greater complexities of colour receivers;
- Evaluate new components and techniques as they are announced;
- Anticipate as far as possible what components will be obtained locally and what will be imported;
- Freeze their initial designs in time for production and release ahead of C-Day — but not so soon that it will be obsolete before the colour service begins.

The would-be designer of a receiver for home construction must face parallel problems but without the assurance of a professional purchasing officer whose job is to obtain all the requisite components for a production run, before the run starts. A home construction project rests on promises of supply which may not be honoured for quite unforeseen reasons, when the time comes.

As we have said, the position may change closer to C-Day; it is difficult to say. Manufacturers may come to light with pre-adjusted modules suitable for home assembly, or modules that don't need adjusting. Deflection components, along with recommended circuitry may become available, as they did in 1957. Constructors may opt for colour tubes less large, less massive and less daunting in their price than those required for full-size consoles.

The price level may appeal — or it may not.

It is one thing to tackle a project costing a few dollars or even a hundred dollars. If it doesn't work out as well as it should, there will be a certain amount of disappointment and possibly a certain amount of recrimination at domestic level.

But what about many hundreds of dollars worth of colour TV parts that fail to produce the anticipated picture? It wouldn't be funny!

Many hundreds of dollars?

The March 1972 issue of "CQ" magazine featured and reviewed the Model GR-371 MX colour television receiver kit marketed in the USA by Heath, under the title Heathkit. Wilfred M. Scherer, Technical Director of the magazine is unstinting in his praise of the project. It apparently went together without any problems, involving in the region of 40 to 60 hours work, depending on the intensity of the effort put into it. He does warn that mounting the picture tube and installation in the cabinet is a two-man job, because of the weight of the units involved.

The price of the 25-inch receiver? US $579.95, for the chassis and picture tube plus US$134.94 for the cabinet, making a grand total of US$714.90.

This is a big, luxury receiver, to be sure. For a 23-inch receiver (chassis only) the price mentioned by Scherer is $539.95, and $349.95 for a 14-inch styled as a portable. These, of course, are American prices, reflecting the relatively modest price levels of electronic components in that country and the buying resources of a very large specialist company. Comparable kits of components, purchased ad hoc over the counter in Australia would almost certainly be well above these levels.

You may well react along the lines that, for this kind of money, it should be possible to buy a ready-built receiver, with no risk, no sweat, guarantees and the options of time-payment. In fact, a catalogue recently to hand from the USA quotes a Sony Trinitron portable with 12-inch screen at US$299.95. A Sony Trinitron 17-inch table model sells for US$399.95. For a Panasonic 16-inch portable the price quoted is US$324.95.

Why then do people in America build their own colour receivers on a scale sufficient to support specialist kit suppliers? Presumably not for any pecuniary advantage but simply for the satisfaction of having done so.

Interestingly enough, about the time we noticed the article in "CQ", a catalogue and price list came to hand for Heathkit projects from their Australian distributor: Schlumberger Instrumentation Australia Pty Ltd, PO Box 138, Kew 3101.

It shows the landed cost of Heathkit colour television kits as ranging from A$411.72 for a portable receiver to A$682.31 for a 25-inch chassis. To these two figures, duty adds respectively $165.51 and $274.28.

Add 27½ per cent sales tax and the final figure for the kits over the counter, is $735.96 for the portable and $1219.65 for the big 25-inch job.

And the cabinet for the 25-inch set? An extra $252.25, including duty and sales tax!

While the foregoing figures are quoted to emphasise a point about price levels, they are of academic interest only in this country. All the receivers in question would be for American standards and for the NTSC system of colour presentation. Whether it would be worthwhile to develop a version for Australian standards would be up to the companies concerned to say.

One other point would be worth making: The 25-inch receiver constructed by Wilfred Scherer for CQ magazine involved five separate manuals for the construction and adjustment of the chassis, one of them being 160 pages. A sixth manual covers fitting to the cabinet.

One must certainly take one's hat off to the characteristic thoroughness of the Heathkit presentation — but by the same token the space required can only dismay the editor of an ordinary journal, who can devote just so many pages to a project before non-interested readers protest.

I am well aware that much of this makes depressingly negative reading, but I would hope that it is also factual and objective.

As local engineers and manufacturers address themselves seriously to the design of colour television receivers, the results of their effort may spill over into the component supply area. We shall certainly be watching the position but, right now, it is easier to be hopeful than optimistic.

We'd like to know what readers think about this — but not in terms that "somebody ought to do something". Do you personally want to build your own colour receiver? Are you concerned about costs relative to commercial receivers? How would you cope with the "it doesn't work" risk?

THE SERVICEMAN

Service — A Cinderella Industry?

I have two stories this month, neither of which is very flattering to the set manufacturer. More important, I am rapidly being forced to the conclusion that the serviceman, who has never been given much of a break, is being considered less and less in the march of progress. See what you think.

The first story concerns an 11in solid state portable TV set, of local manufacture, which was suffering from weak sound. Taken at face value, that description should not strike fear into the heart of the average serviceman. One would expect that, if he was worth his salt, he should be able to knock a couple of such jobs over before breakfast.

Well, in a manner of speaking!

At least, that's what I thought until I struck this job. And it is not simply this individual case that is worrying me, but the implications in regard to the whole servicing scene. I think you will appreciate why when I have finished the story.

A preliminary check indicated that the audio system was functioning normally and, since the picture appeared to be normal, it appeared that the fault was somewhere between the video detector, where the sound IF was picked off, and the ratio detector output.

This part of the set — the sound IF, limiter, ratio detector — is built around an IC, an IF transformer, a ratio detector transformer, and a few minor components. A voltage check around this section suggested that all was well with the associated components. Voltage was being applied to, or was appearing on, all the right pins, transformer windings were intact, and so on. It seemed almost certain that the trouble was in the IC.

So far, all appeared to be plain sailing. All I had to do was obtain a replacement IC and fit it. The number was clearly marked on both the unit itself and the manufacturer's circuit diagram. I contacted one of my usual suppliers and was assured that he could supply it ex-stock. So far, so good. But I was curious to learn more about the IC; what it consisted of, its ratings, etc. After all, there is nothing like keeping up to date on these things.

Yet, search as I might, I couldn't find the type number listed in any of my data sheets. Finally, I rang the service department of the set manufacturer. And, believe it or not, they could supply no information about it either. Very frustrating to say the least but, as the information wasn't essential to the job, I didn't waste any more time searching.

The main thing was to get the replacement IC fitted, when it was duly delivered. Funny thing, though, although it carried the same type number it wasn't exactly identical with the original. The most disturbing difference concerned the indexing spigot which, instead of being between two pins, as in the circuit and the original, was opposite one pin.

This made it difficult to positively identify the pins, until I hit on the idea of identifying the common pin, connecting to the case, by means of an ohmmeter. Using this as a reference, I simply wired it in the same manner as the original.

A word of warning here though. If you should find yourself in a similar predicament, be careful how you use the ohmmeter. Certain ranges of certain types of ohmmeters could create dangerous voltage or current conditions inside the IC if one happened to test other than the case lead. It is impossible to lay down hard and fast rules, but most servicemen would be aware of the currents and voltages involved in their own instruments.

But to get on with the story. I fitted the new IC and switched on hopefully. No joy. The sound section was completely dead. Had I overlooked some subtle fault in one of the associated components? I went over everything again. All voltages checked out OK and I made a thorough check of the transformers, capacitors, resistors etc, but could find nothing wrong.

As can be appreciated, all this took a considerable time. Working on the assumption that the IC was a good one, I had to assume that one of the other components was faulty. But when I could find nothing wrong I found myself going over the same components several times, convinced that there was a fault, and that I just couldn't see it.

Finally I gave up. New IC or not I concluded it too must be faulty. After all, brand new devices can be faulty. So I obtained a second IC from the same supplier. Results were almost exactly the same, except that there was now very weak, very distorted sound.

This time I nearly went up the wall. The idea of two brand new faulty ICs in a row was so preposterous that I was forced to dismiss it as wishful thinking. There just had to be some other explanation.

So I went over everything again, pulled out all the stops and tested each component by every possible means at my disposal. Again I came to a blank wall. It couldn't be the IC yet, by my book it wasn't any of the other components either.

At the point of desperation I clutched at the only straw I could see. In spite of the long odds, it just had to be the IC. I would try a third one, if only because it was cheaper than sitting there going over the same ground umpteen times. I made one other decision. If it was the IC then I had bought two faulty ones in a row. Did this dealer have a faulty batch? I decided to buy the next one somewhere else.

As it turned out, the only "somewhere else" I could find was the maker of the set. When this one was delivered I noticed a curious thing; the indexing spigot on this one was in its correct position between the pins, as was the original.

When I fitted this one the set went first try, and performed perfectly when the transformers were peaked. A victory? Perhaps, but a dreadfully hollow one.

In fact, the whole incident leaves a very nasty taste in the mouth and prompts a number of very pertinent questions.

First, from a purely technical point of view, what was wrong with the ICs whereby they were able to establish the correct DC voltages in all parts of the circuit, yet were unable to process the signal? Were they actually faulty or were they not really the same device at all, but a similar one, incorrectly marked, which just happened to produce the correct DC voltages?

More importantly — from a business point of view — who pays for the six or seven hours wasted on the job? The customer certainly won't, nor will the IC manufacturer. Which leaves only yours truly. It would be a gross understatement to say that I didn't make any money on that job; in fact I lost substantially.

Again, who takes the blame for the length of time it took to fix a relatively simple fault? (The whole exercise was, of necessity, spread over many days) Again, the answer is yours truly, unless I am lucky enough to be able to convince the customer otherwise.

Finally, what can the average serviceman do to guard against such a situation? The answer, I'm afraid, is very little. Whereas valves and transistors can be tested independently in appropriate testers, there appears to be little likelihood that an equivalent device for ICs will ever be a practical proposition. The highly complex nature of these devices, plus the fact that they can be produced in an infinite variety, rules out any chance of a simple IC tester.

This puts the serviceman completely at the mercy of the IC manufacturer and leaves him wide open to the very situation which I experienced.

Which brings me to the whole point of this story. The serviceman has always been something of a Cinderella in the radio and TV industry, with one ugly sister in the form of the manufacturers, who have generally given scant consideration to the problems of servicing their own products. The other ugly sister is in the form of the general public who complain bitterly when this very lack of consideration rebounds in the form of difficult service jobs and high charges.

For a while, not so long ago, it looked as though our fairy godmother was about to burst upon the scene. We were regaled with stories of completely new construction methods, including the modular concept, which would reduce servicing to a mere routine operation. So far I have seen little of this in practice, and what I have seen has

not impressed me — to put it mildly!

To date, the change-over to solid state techniques, particularly in regard to TV, has done little to improve the serviceman's lot, and a great deal to impair it. And the situation does not appear to be improving.

Don't misunderstand me. I am not suggesting that we should not have the kind of overall progress which solid state techniques can offer. That would be foolish and completely unrealistic. Nor am I so unrealistic as to expect that every new technique and device will be perfect from the word go.

What I am saying is that too many mistakes which are born in the laboratories and production lines finish up being left on the serviceman's doorstep. Personally, I feel that it is time those who create the electronic monsters should be prepared to accept some responsibility for their after care.

To emphasise my point, here is another story. It is about this same model set, though not the same actual unit. The set as I received it had a blown out power transistor in the line output stage. In addition, there was a rather vague history of the same thing having happened on a previous occasion, and having been repaired by another serviceman.

Having confirmed that the transistor was, in fact, blown, I checked all likely associated components to satisfy myself that none of these was responsible. Finding nothing wrong I fitted a new transistor, whereupon the stage came to life. Conscious of the previous failure I went over the circuit with a CRO and meters, in a further effort to find anything which might contribute to such a failure. As far as I could see, there was nothing abnormal anywhere.

Yet I had hardly finished the tests when the transistor packed it in. Convinced that there was some subtle fault which I had not found, I went over the set again, with more detailed reference to the circuit. This time I realised that the two did not agree.

The upshot of this was that I rang the maker's service department and asked about modifications in general and in particular about any concerned with protecting the line output transistor. No one seemed to know much about this particular problem, but they admitted that there had been a number of changes to this part of the set, and promised to forward a list of the modifications.

When these subsequently arrived I was rather shocked at the number of changes involved. It was pretty obvious that the design boys had had a lot of "second thoughts" about this and other parts of the circuit.

But I was even more shocked to realise that, even with all these changes to the circuit, the set would still not agree with it.

I rang the service department again; could someone please explain what was going on? The best reply I could get was to the effect that, yes, they thought there had been some changes of this nature, but they weren't too sure exactly what they were or why they had been made. I gave up in disgust.

It was only by sheer chance that I finally discovered the vital piece of information concerning the safety of the output transistor.

The power transistor I had blown up was the last one in stock. Supplies around the

(Continued on page 126)

Test with the Best, Test with a Sanwa.

N-SERIES

N-101 ● Dual voltage and current ranges are lined up in different colours for errorfree selection. ● LI and LV scales test the quality of semiconductors. ● Meter movement protection ● Solid-state rectifier.

Ranges
DCV: (LO) 0.3 1.2 6 30 120 600 (50 kΩ/V) 30 k w/HV probe
(HI) 0.6 2.4 12 60 240 1200 (25 kΩ/V)
ACV: (LO) 6 30 120 600 (10kΩ/V)
(HI) 12 60 240 1200 (5kΩ/V)
DCA: (LO) 3μ 3m 30m 300m (240mV)
(HI) 6μ 6m 60m 600m (480mV)
Ω: X1 X10 X100 X10 k (max. 50 MΩ)
dB: −20~+63
Accuracy DC±3% AC±4% f.s.
Batteries 1.5 V (UM-3)×1 & 9 V (006 P)×1
150×104×52mm, 600 gr

The Tester of the World:

100 Countries

N-201 ● Ultrahigh input impedance by a transistor amplifier. ● Quick response to indication. ● LI and LV scales test the quality of semiconductors. ● Meter movement protection ● Solid-state rectifier.

Ranges
DCV: 0.3 1.2 3 12 30 120 (200kΩ/V) 600 1200 3000 (20 Ω/V) 30 w/HV probe
ACV: 3 12 120 300 600 (10 kΩ/V)
DCA: 6μ 0.12 m 3 m 30 m 600 m 3 (300 mV)
Ω: X0.1 X10 X100 X1 k (max. 50MΩ)
dB: −20~+57
Accuracy DC ±3% AC±4% f.s.
Batteries 1.5 V (UM-3)×4
Freq. 30 Hz~100 kHz
150×104×52 mm, 600 gr

N-301 ● DCV and ACV are read on a common linear scale, diode compensated. ● Function switch for polarity reversal. ● Instantaneous action of the breaker against inadvertent overload. ● Resettable circuit breaker ● Solid-state rectifier.

Ranges
DCV: (±)0.25 1 2.5 10 50 1k (20Ω/V) 25 k w/HV probe
ACV: 2.5 (6 kΩ) 10 (35 kΩ) 50 250 1 k (4 kΩ/V)
DCA: (±)50μ 1m 10m 100m 1 10 (250 mV)
Ω: X1 X10 X100 X1 k X10 k (max. 20MΩ)
Accuracy DC ±2% AC±3% f.s.
Batteries 1.5V (UM-2)×1 & 9V (006 p)×1
Freq. 50 Hz~100 kHz
225×174×94 mm, 1.4kg

N-401 ● Taut-band suspension meter movement. ● Function switch for polarity conversion. ● Instantaneous action of the breaker against inadvertent overload. ● Resettable circuit breaker ● Solid-state rectifier.

Ranges
DCV: (±) 0.16 0.4 1.6 4 8 16 40 (200 kΩ/V) 160 (16MΩ) 400 800 (20MΩ) 1.6 k (40MΩ) 30 k w/HV probe
ACV: 4 8 16 40 160 400 1.6 k (5 kΩ/V)
DCA: (±)8μ 40μ 0.4m 1.6m 4m 16m 40m (400mV) 160m 1.6 16 (500mV)
ACA: 1.6 16 (400mV)
Ω: X1 X10 X100 X1 k X10 k (max. 50MΩ)
Accuracy DC±2% AC±3% f.s.
Batteries 1.5V (UM-3)×1 & 9 V (006p)×1
Freq. 50 Hz~200 kHz
252×191×107mm, 1.95 kg

The Tester of Japan:

80% Market Share

FOR MORE INFORMATION OR DEMONSTRATION CONTACT:

WF WARBURTON FRANKI

- ADELAIDE 56-7333
- BRISBANE 51-5121
- HOBART 23-1841
- MELBOURNE 69-0151
- PERTH 25-7787
- SYDNEY 648-1711

WF2-17021

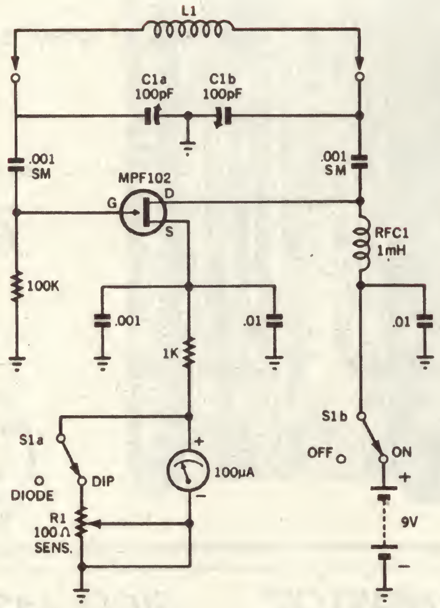
CIRCUIT & DESIGN IDEAS

Interesting circuit ideas and design notes selected by the Editor from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Contributions to this section are always welcome.

A Simple FET Dipper

Most solid-state dippers use a diode to rectify the RF energy present at the collector or drain terminal of the oscillator. The rectified RF is used to drive a DC amplifier and the amplifier operates a meter. This technique is fine provided the dipper is not coupled too tightly to the circuit under test, a condition which can cause the RF voltage to fall below the conduction point of the diode — approximately 0.4 volt for a germanium diode, and 0.6 volt for a silicon diode. When the diode no longer conducts, the meter indication falls to zero, thereby preventing one from obtaining a reading.

The circuit shown was tried and the performance was good. There are no dead spots in the tuning range and a pronounced dip in meter reading can be obtained without experiencing diode "dropout". Changes in drain current are observed on a 100uA meter. When S1 is placed in the DIODE position, the instrument can be used as an indicating wavemeter. In this mode the source-gate junction rectifies the sampled RF to provide an indication on the meter.



In the circuit diagram, fixed value capacitors are disc ceramic unless otherwise noted. SM is silver mica. Capacitance is in pF except decimal values which are in uF. Fixed resistors are ½W carbon types. C1 is a 100pF per section miniature air variable and R1 is a 100 ohm linear potentiometer.

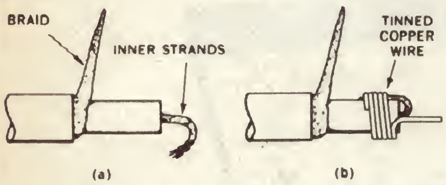
COIL DATA
1.5-3.4MHz 214 turns 34B&S enamel
2.7-6.0MHz 125 turns 34B&S enamel
4.8-10.2MHz 58 turns 30B&S enamel
8.7-19MHz 34 turns 22B&S enamel
18-40MHz 16 turns 18B&S enamel
35-80MHz 8 turns 18B&S enamel
70-160MHz hairpin ⅝in x 2in 10B&S enamel

Coils for the FET Dipper are wound on ⅝in diameter plug-in formers, 2½in long. The two low-band coils have windings which occupy 1½in (close wound). All others (except the high-band hairpin) occupy 1in on the former, turns spaced where applicable.

Keep all leads as short as possible to assure proper frequency coverage at the upper end of the operating range. — W1CER.

(From "QST")

Terminating Coaxial Cables



It is often a difficult job to produce neat, strong connections with co-axial cable, and the inner wires seem to break off with annoying frequency. A method of termination used in industry, but which may not be known to hobbyists, helps prevent this sort of failure.

The termination is made as follows:

1. With a sharp knife, cut around the outer insulation about an inch from the end, and remove it from the cable. Take care not to score or nick the copper braid.
2. With a spike or small screwdriver tease out the braid strands and twist them together to form a "tail" leaving the inner insulation revealed.
3. Strip off about ¼in. of inner insulation. One way of doing this without fear of damaging the inner strands of the wire is to run the tip of a hot soldering iron round the insulation — a rather smelly but effective method!
4. Fold the inner strands back along the insulation. The cable end should now be as in Fig. (a).
5. Take a length of tinned copper wire (20 or 22SWG.) and wrap it tightly round the strands and insulation, leaving a piece projecting to provide the inner connections. See Fig. (b).
6. With a clean hot iron run solder round the tinned copper wire and inner strands.
7. Leave to cool, after which it will be found that the tinned copper wire has been soldered on to the inner strands and has also melted into the inner polythene insulation.
8. For additional protection a rubber sleeve can, if desired, be put over the inner connections to prevent any danger of the braid connection short-circuiting against it.

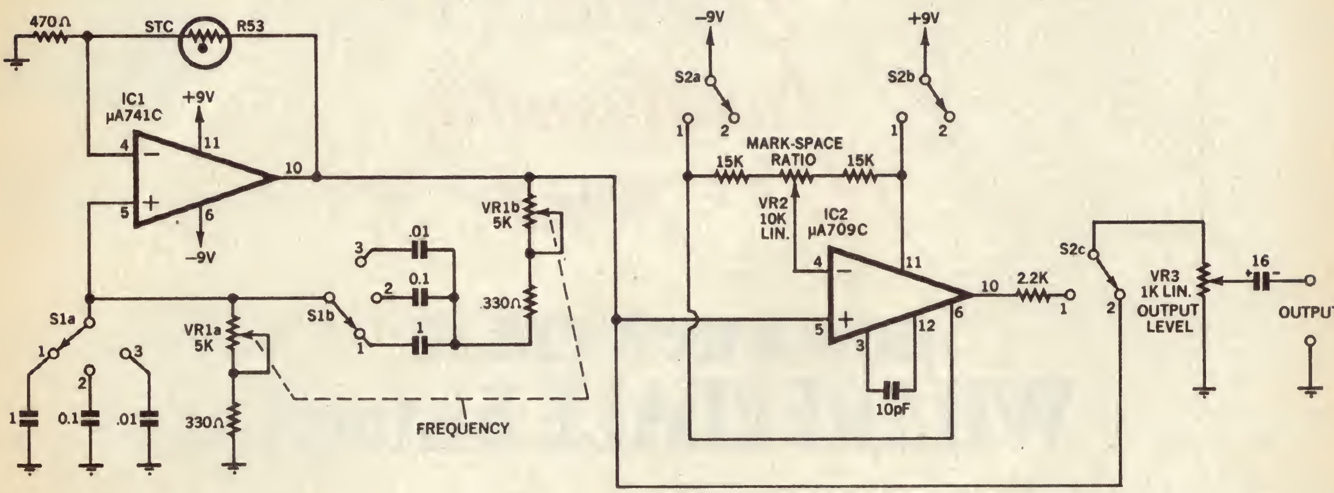
(From "Radio-Constructor".)

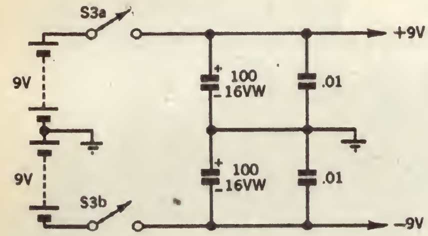
Audio Oscillator Uses Two ICs

Here is a circuit for a useful audio test oscillator which incorporates two IC operational amplifiers. The frequency coverage is from 30Hz to 30KHz, in three ranges. Sine wave and variable mark-space square wave outputs with variable output level, are available.

IC1 and its associated components go to make up a conventional Wien bridge oscillator, with amplitude stabilisation provided by a thermistor. An IRC logarithmic curve 'E' dual potentiometer helps to linearise the frequency calibration of the dial. An output of 1V RMS is obtained for loads of 300 ohms or more, with low distortion.

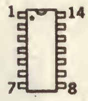
IC2 is the sine/square converter and which is a high gain "open loop" voltage comparator. The output switches very rapidly from positive to negative, depending on the comparison between the reference voltage selected by the mark-space potentiometer and the instantaneous value of the sine wave input. The converter produces a square wave output of 5V peak-to-peak for a load of 10K or more. Useful square waves of reduced amplitude are





S1 : 1 :30 — 300Hz
2 : 300 — 3000Hz
3 : 3000 — 3000Hz

S2 : 1 : SQUARE WAVE
2 : SINE WAVE



IC1, IC2
TOP VIEW

obtained for loads down to a few ohms.

Since the power requirements are low, a dual 9V battery was chosen, which makes the test oscillator very compact and portable. In the square wave mode the current drain is about 5mA from each 9V source. For the sine wave mode S2 switches IC2 out of circuit and the current drain is about 2mA. The double pole ON / OFF switch S3 can be incorporated in VR1.

(By Mr C. S. Fisher, 18 Langdale Avenue, Revesby, NSW 2212.)

A Two-Way Mobile Tuning Aid

It is not certain just how widely this little unit is known, but I have found it invaluable for tuning up two-way mobile receivers after the front end has been modified from the original frequency. The original idea was extracted from an American magazine about nine years ago by Bill, VK2BMX.

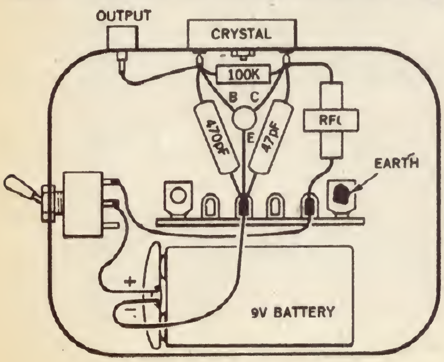
The circuit specifies a type 2N3964 transistor and a 2.5mH RF choke. I am successfully using a BF115 transistor and a smaller value of RF choke which I salvaged from a scrapped TV receiver.

(By Ken Hargreaves, VK2ZIL, in VHF & TV Group "Newsletter", WIA, New South Wales Division.)

Editorial note: Our Assistant Editor, Philip Watson, has made up one of these units for his own use and a detailed drawing is shown herewith. It is built into a "Strepsils" tin which measures 3¼in x 2½in x ¾in and includes a battery, switch, crystal socket and miniature coax socket to take an aerial. The aerial consists of a 7in length of stiff hookup wire soldered to a miniature coax plug.

This unit has been used to tune up modified two-way mobile receivers for both the 52 and 144MHz bands, using the crystal from the companion transmitter. It is also invaluable for tracking down interference on an FM receiver, such that the required signal level can be provided in the receiver, while steps are being taken to trace and remedy the interference.

The required signal strength for adjustment and alignment purposes may be obtained by the simple expedient of varying the distance between the receiver and the oscillator. It was observed that with the lid on the oscillator case and without the aerial, a signal could not be detected beyond a few inches from the receiver aerial input.



More Complex Receivers

Limitations of simple receivers — the RF amplifier stage, its operation and use — neutralisation — gain control of TRF receivers — the superheterodyne principle, its operation and advantages — autodyne converters — transistor receivers — more elaborate receivers.

While a beginner may concentrate initially on building small regenerative radio receivers of the type discussed in the last chapter, he must inevitably wonder about the design of larger receivers. In this chapter, we explain the basic idea behind two well-known types of receiver, the "TRF" and the "superheterodyne."

In an explanation of reasonable length, it is not possible to discuss individual circuits in detail — the how and why of every resistor and capacitor. The reader will have achieved something, however, if he can understand the general idea behind these circuits, particularly the superheterodyne.

Having grasped the basic idea, it should be possible to enlarge upon it later by studying the circuit and design information on actual receivers.

The TRF and, later, the modern superheterodyne receiver, came as a natural development from the desire to produce receivers which were more sensitive, more selective and more suitable for use by non-technical members of an ordinary household than regenerative receivers.

The story of the development of these types of receiver is really a continuation of the story told in chapter 11 about small receivers, and it must inevitably read like a piece of radio history.

As we pointed out in the last chapter, a receiver having a regenerative detector followed by two audio stages is capable of receiving a great many stations, both on the broadcast and short-wave bands.

By using a power transistor or valve in the final stage, such a set can operate a loudspeaker at good volume on the stronger stations and, in the early days of radio broadcasting, many domestic receivers were of this general type.

For domestic use, however, such receivers have certain basic limitations.

In the first place, performance depends very largely on proper use of the reaction (regeneration) control. If it is too far advanced, the set oscillates, producing whistles in its own loudspeaker and in neighbouring receivers tuned to the same station. If the reaction control is not sufficiently advanced, perhaps to limit volume, selectivity is likely to suffer to the point where two or more signals are heard together.

While this is no special problem to anyone who understands what the controls are for and how they are supposed to be adjusted, it did prove an embarrassment in the early days for non-technical members of the household. Some less critical arrangement was obviously desirable for general use.

Another difficulty which was experienced with early simple regenerative sets lay in the fact that there was a practical limit to the amount of amplification one could provide following a detector. Thus, while one or two audio stages could be used to usefully increase gain and even selectivity (the latter by roundabout means), anything more than this tended to lead to difficulty.

Slight vibration in the detector valve, causing slight changes in plate current, could be amplified by subsequent staged to produce wnat are known as microphonic effects. Tapping the valve, or even normal vibration, would produce thumps and ringing noises from the loudspeaker.

Then again, noise due to electron flow in the detector itself could be amplified to the point where it produced a continuous background hiss. And in mains-operated receivers, very slight 50Hz or 100Hz voltages, coupled into the detector circuit from the heater and power supply tended to produce an audible hum from the loudspeaker.

Last, but not least, slight variations in high-tension supply voltage, caused by plate current variations in the output valve, could be fed back as a spurious signal to the plate of the detector. If regenerative, this feedback was able to cause an effect called motor-boating, evident as a regular pop-pop-pop noise from the speaker.

While all the problems could be minimised by careful design, they did set a limit beyond which the detector-plus-audio idea became rather impractical.

This limit was reached very early in the history of broadcasting, and designers had to find other means of improving the performance of their receivers. Since additional stages could not be added after the detector, the only alternative was to add stages ahead of the detector and to amplify the incoming signal at its own frequency.

Such stages were known as radio-frequency amplifier stages or simply RF stages.

Now an ordinary valve would not amplify radio frequency signals very effectively if merely coupled to the following stage by a resistance-capacitance network or by some kind of audio transformer. It would give a great deal more amplification if coupled to the following stage by means of a circuit tuned to the incoming signal frequency.

The essential circuit details of a valve-type tuned RF amplifier are shown in figure 1. This is the type of RF amplifier stage used in early receivers, and still used on occasion nowadays.

The incoming signal is fed through a tuned circuit to the grid of the RF amplifier valve. The coil of this tuned circuit is normally referred to as the "aerial coil". It is connected directly to the grid of the valve, without any capacitor or resistor, because the valve is intended to operate as an amplifier rather than as a detector. For the same reason the valve is provided with grid-cathode bias — here by means of a bypassed cathode resistor — to ensure operation as a class-A amplifier.

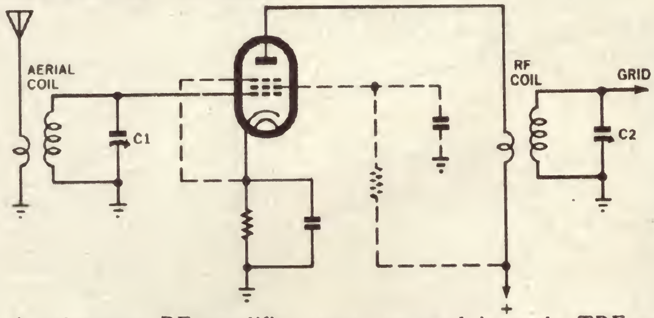


Figure 1: A valve-type RF amplifier stage, as used in early TRF receivers. The additional connections for a pentode are shown dashed.

Amplifier signal output current from the plate circuit flows through the primary winding of a second coil assembly, and is coupled into a tuned secondary winding, the two windings forming what is commonly referred to as an "RF coil" or RF transformer.

The secondary windings of both the input and output tuned circuits, with their associated capacitors, must be capable of tuning over the entire broadcast band. To receive any given station, both tuned circuits should be set to the frequency of that station.

Under these conditions, the signal from the desired station is selected and passed to the RF amplifier grid, in preference to other signals which may be present. It is amplified by the RF amplifier valve and passed through the second tuned circuit, which also favours the desired signal and tends to reject signals on other frequencies.

In other words, the use of a tuned RF

stage not only provides amplification, but also increases selectivity. This was — and is — a most important point.

Since an RF amplifier stage feeds into a circuit tuned to the signal frequency, this is the only frequency which it can amplify properly. Because there is no load resistor in the plate or collector circuit and no audio transformer, it cannot amplify significantly or pass on signals within the audio range. Therefore, it is not nearly as susceptible as an audio stage to hum, hiss, microphony or motor-boating. This, too, is important.

Many early receivers used one triode RF amplifier stage, a regenerative detector and two audio stages. They were the first "TRF" receivers, the letters indicating the use of a tuned radio frequency amplifier stage.

Such receivers were generally better than earlier types without the RF stage. They had better gain and selectivity and therefore relied to a lesser extent on critical setting of the reaction control. And because there was an amplifier stage between the detector and the aerial, the reaction setting was not affected so much by the type of aerial in use.

For all that, the basic problem remained that there was still a reaction control to set, and attempts were made to produce receivers with two RF amplifier stages ahead of the detector, but with no reaction.

Here designers came up against the full measure of a problem which was mentioned in chapter 6. They found that, because plate and grid in a triode were side by side, there was considerable capacitance between them and energy was being fed back from plate to grid as a result.

In detector or audio service it did not matter a great deal, but in RF stages, with both grid and plate circuits tuned to the one frequency, the feedback tended to cause oscillation. One low-gain triode RF stage was practicable (even if barely so) but two such stages were almost unmanageable.

A temporary answer to the problem was found in the so-called "Neutrodyne" principle, which enjoyed some popularity in the late 1920s. The primary winding of the RF coil was centre-tapped so that a signal voltage appeared at the lower end similar to but out-of-phase with the signal voltage at the plate end. A small variable capacitor was connected from the lower end of the primary to grid and adjusted to have the same value as the grid-plate capacitance of the value.

Being connected in this fashion, this so-called neutralising capacitor fed back to the grid a signal equal to and out-of-phase with that fed back from the plate, so that the two cancelled out. As a result, the tendency to oscillation was overcome and two triode RF amplifier stages bacame practical.

The early "Neutrodyne" receivers were, therefore, a special type of TRF receiver, employing the principle of neutralisation.

In point of fact, neutralised TRF receivers did not enjoy a lengthy period of popularity because valve designers came to light with the screen-grid principle. Applied in RF tetrodes and pentode valves, it almost eliminated grid-plate capacitance, and therefore, eliminated the major source of instability in RF stages.

As a result, it became possible to achieve high figures of stage gain, and, further, to use two high-gain stages in sequence. Nor was there any great trouble with instability. By shielding the valves and coils and adopting a layout which kept input and output leads reasonably apart, such a set could remain completely stable, even under full gain conditions.

With such gain available and the selectivity afforded by three tuned circuits, reaction became unnecessary, and the reaction control therefore largely disappeared from sets of the day.

By carefully matching tuning coils and adding small variable trimmer capacitors across each tuned circuit, designers were able to gang together the three tuning capacitors and operate them from a single tuning dial. This done, domestic receivers became really simple to operate for the first time — one dial to select the station and one knob to control the volume.

TRF receivers reached their heyday about 1930 and their general design followed the pattern shown in the block schematic diagram of figure 2.

were coming on the air, crowding the broadcast band and ever increasing the demand for selectivity. The limitations of the simple TRF soon became apparent, particularly for the more difficult reception areas.

To add yet another RF stage or yet another tuning circuit gave only limited improvement at the cost of much greater complexity and with the attendant risk of instability. What was more there didn't seem to be any obvious way of making tuned circuits much more efficient. To resort again to reaction as an aid to selectivity was unthinkable to a commercial designer.

As a result, they began to look for other basic methods of receiver design and the one which seemed to hold the greatest promise was the superheterodyne principle.

This was not new, having been developed by Edwin H. Armstrong of Columbia University in New York as early as 1921. It had been used in a limited way for many

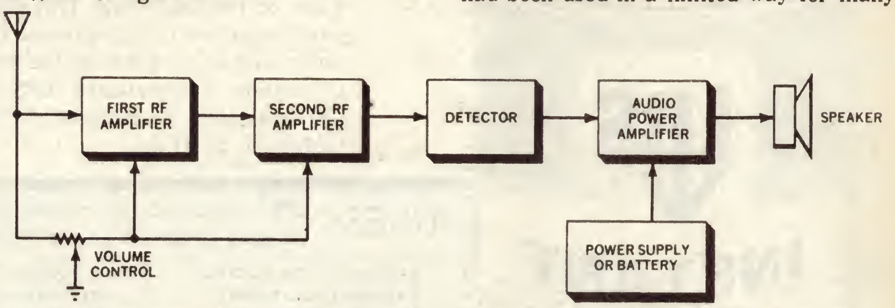


Figure 2: The basic arrangement used in early TRF radio receivers. Such receivers had their heyday in the 1930s.

The incoming signal was fed by the aerial coil to the first RF amplifier stage, then passed to the second RF amplifier stage and thence to the detector. This was followed by a single audio stage, but, using a sensitive pentode valve, which gave high amplification as well as ample power output to operate a loudspeaker.

Power to operate all these stages came, in mains receivers, anyway, from a power supply built on to the same chassis. This included a power transformer, a rectifier, a filter choke of some description and two or more filter capacitors. (More will be said about the operation of this section of the circuit in a later chapter.)

The volume control in such receivers usually took the form of a potentiometer connected at one end to the two RF amplifier cathodes, and at the other to the aerial terminal. The adjustable tapping went to earth. With the moving arm towards the cathode end, the RF amplifier valves operated with minimum bias and maximum gain, while the amount of resistance between aerial and earth was too high to make any real difference to its efficiency. Adjusting the control the other way applied high bias to the RF amplifier cathode and reduced the stage gain; at the same time it shunted the aerial to ground and therefore reduced the signal input.

It might be thought that the evolution of the TRF receiver would have largely halted receiver development in that it provided good gain and selectivity with plenty of acoustic output and simplicity of operation.

But it didn't.

About the same time, many new stations years, mainly in professional and military short-wave receivers. Could it be adapted for use in domestic radios? Designers soon found that it could.

Designed around the better valves available, and using modern circuit techniques, the superhet receiver quickly established itself in popular favour, and has remained undisputed leader ever since.

But how does the superhet work? At this point, we can drop the semi-historical sort of discussion and settle down to some straight theory. This is appropriate, because the superhet principle does not yet belong to history. Practically every modern broadcast, communications and television receiver uses the principle.

As the name suggests the superheterodyne receiver utilises a method of heterodyning or beating two signals together. Let's explain this.

It has been found that, when two signals are fed into a non-linear circuit, they combine to produce signal voltages at frequencies additional to and distinct from either of the original input frequencies. Further, that these new frequencies are equal to the sum and the difference of the original frequencies.

Consider, for example, two frequencies which we shall designate as f1 and f2. If fed into a non-linear amplifying stage, it would be possible to detect output voltages, as expected, having the original frequencies f1 and f2. But, in addition, we would find that output voltages were present at frequencies equal to f1-plus-f2, and f1-minus-f2 (assuming f1 to be the higher numerical value).

Taking an actual case, we may feed

NEW!

LPS INSTANT COLD GALVANIZE . . .

equals hot-dip galvanizing at 1/2 the cost

Available in 16 oz. Aerosol spray-cans

LPS Instant Cold Galvanize is a ready to use 95 p.c. PURE ZINC compound that provides long-lasting protection from rust and corrosion.

LPS Instant Cold Galvanize is NOT A PAINT! When applied to iron or steel it generates a positive electric current that flows to the base metal. This electrochemical action fuses the zinc compound with the metal. Corrosion will attack only the outer zinc coating leaving the metal to be protected rust free. If coating is penetrated LPS Instant Cold Galvanize will sacrifice itself to protect the exposed base metal. RUST CANNOT SPREAD.

USES:

LPS Instant Cold Galvanize should be used wherever metal is exposed to corrosive conditions such as in the construction and maintenance of:

AUTO & TRUCK BODIES	RAILROADS	TRAILERS
FARMING EQUIPMENT	WATER TANKS	FENCING
MARINE EQUIPMENT	MOTOR BIKES	OIL RIGS & PIPE LINES
METAL ROOFS & FLOORS	TV AERIALS	STRUCTURAL STEEL
MINING EQUIPMENT	SNOWMOBILES	LINES & TOWERS
OFF-SHORE STRUCTURES	GOLF CARTS	UNDERGROUND EQUIPMENT
POWER PLANTS	PATIO FURNITURE	LAWN & GARDEN EQUIPMENT

AIR CONDITIONING, HEATING, & REFRIGERATION SYSTEMS

TECHNICAL INFORMATION:

Passes PREECE TEST for hot-dip galvanizing
SINGLE APPLICATION THICKNESS — approximately 1½ mils
COVERAGE — approximately 50 square feet per pound

TOUCH DRY — 1 minute . . . can be painted over in 6 hours or 30 minutes after baking at 350° for 15 minutes

WITHSTANDS:

- Over 3,000 hours in salt spray cabinet
- Water temperature above boiling point
- Continuous dry heat up to 750° F.
- Short period heat up to 1000° F.

SPECIFICATIONS:

LPS Instant Cold Galvanize meets or exceeds the following specifications:

MIL - P - 46105 weld thru primer
MIL - P - 21035 Galvanizing repair (U.S. Navy)
MIL - P - 26915A for steel (U.S. Air Force)
MIL - T - 26433 for towers (Temperate and Arctic Zones) (U.S. Air Force)
Complies with Rule 66-3 Los Angeles and San Francisco

LPS Instant Cold Galvanize provides maximum protection when applied to clean, dry metal.

LPS RESEARCH LABORATORIES, INC.
2050 COTNER AVE. • LOS ANGELES, CALIF. 90025 (213) 478-0095

Distributed by
ZEPHYR PRODUCTS PTY. LTD.
70 BATESFORD ROAD, CHADSTONE, VICTORIA
Phone: 56 7231

signal voltages at, say, 2,000 and 1,500 kilo hertz into a non-linear stage. Both original signal frequencies would be present in the output, plus additional frequencies of 3,500 kHz (2,000 plus 1,500) and 500 (2,000 minus, 1,500).

In actual fact, there may be other frequency components in the output, due to the presence or generation of harmonics, but we can afford to neglect these as being incidental to the main effect.

As we already know, stations on the broadcast band transmit on allotted frequencies, between the limits of 550 and 1600 kHz. To tune and amplify them on a TRF receiver involves the use of a ganged capacitor tuning two or three matched coils.

There are difficulties in the way of tuning more than about three coils in this way, so that the performance of a TRF receiver is largely limited by the selectivity and gain which can be achieved with three variable tuned circuits.

But, in the superheterodyne, the designers utilise the heterodyne principle to change the frequency of any and every desired incoming signal to a new, pre-arranged and fixed frequency. This is passed to and amplified in a section of the receiver, which can employ any desired number of fixed tuned circuits.

The new frequency is usually lower than the signal frequency but still well above the audio spectrum, which is perhaps the reason why it is commonly referred to as the "Intermediate" frequency — usually shortened to "IF."

The particular intermediate frequency is selected by the designer to suit his requirements. If high gain and extreme selectivity is the object, he may choose an intermediate frequency of about 200 kHz. But, with such a low frequency, great care has to be exercised to avoid receiving the same signal at two points on the dial — called "two-spotting" — owing to unwanted heterodyne effects.

An intermediate frequency of more like 2,000 kHz minimises double-spotting, but requires greater attention to the design of the tuned circuits, if gain and selectivity are not to be sacrificed.

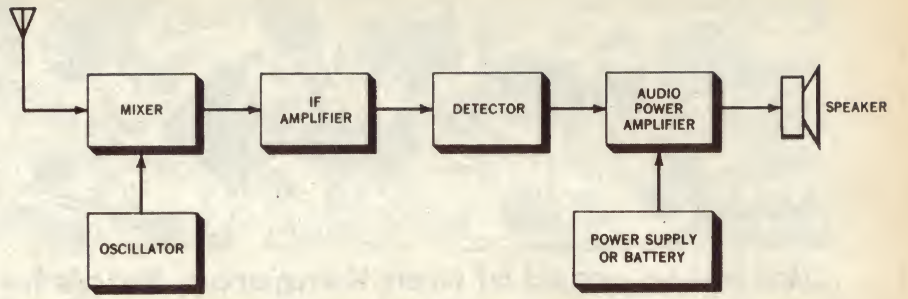


Figure 3: The basic arrangement of a single-conversion superheterodyne receiver. Most modern receivers are of this type.

A compromise figure, which is widely employed in this country, is an intermediate frequency of 455kHz or thereabouts.

Assume that a desired signal is on 1,000 kHz. The first obvious requirement then, is for the tuned aerial input circuit to be resonated to this figure. This is accomplished by tuning the aerial input coil with a variable capacitor, exactly as in an ordinary TRF receiver.

The desired 1,000 kHz signal is then fed into the "mixer" or "frequency changer." In the output, remember one desires a frequency equal to the selected intermediate frequency, which one may assume to be 455kHz.

Essential for the frequency change is an oscillator, which delivers a locally generated signal voltage to the mixer stage. To obtain the desired result, the oscillator would be tuned to 1,455 kHz coming signal frequency by just 455 kHz.

It could alternatively be tuned to (1000-455) or 545 kHz, but the higher oscillator frequency is normally used.

At the output of the mixer stage, one would expect frequency components of 1,000, 1,455, 2,455 and 455 kHz. But the mixer invariably feeds directly into a tuned circuit, which would be resonated permanently at 455 kHz. This one frequency is, therefore, selected and passed on, while the first three mentioned above, together with all other incidental harmonic frequencies, are suppressed.

If the desired signal were on 1,020 kHz, then it would be necessary to increase the local oscillator frequency by another 20 kHz to ensure that the IF output remained at 455 kHz.

Thus, in a simple superhet, there are two variable tuned circuits. One gives intitial selection at the signal frequency, and the other adjusts the local oscillator frequency to a figure which differs from the signal frequency by the selected intermediate frequency.

In the earliest "superhets" the aerial and oscillator circuits were controlled by separate capacitors and tuning dials. But, in all modern sets, the coils are accurately adjusted and the oscillator tuned circuit arranged so that it maintains the required frequency difference automatically. This is called "tracking."

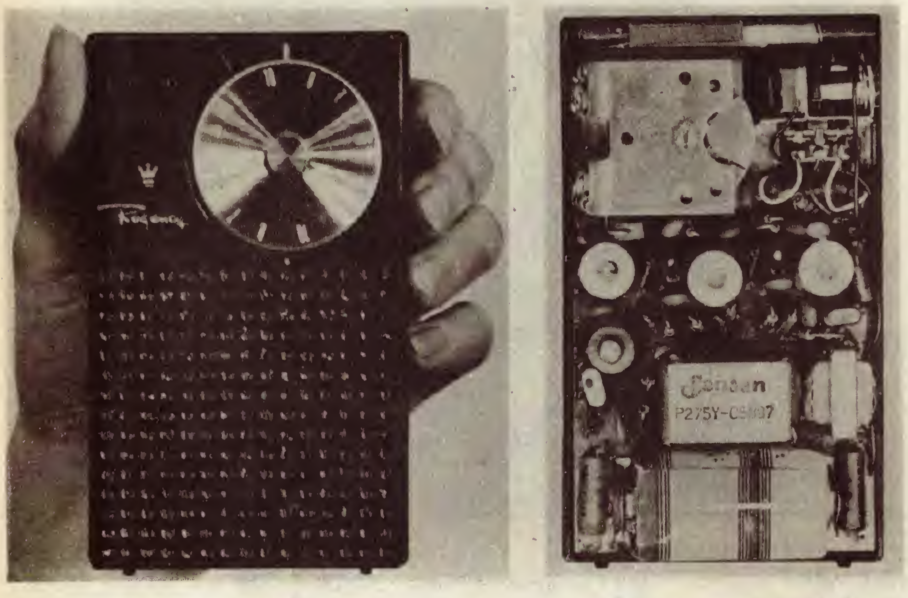
In most modern receivers this is arranged by means of a so-called "padderless gang", a two-gang variable capacitor in which one of the sections has smaller and specially-shaped plates. An alternative technique, and that generally used for short-wave receivers, is to use a conventional tuning capacitor with a so-called "padder" capacitor connected in series with the section used to tune the oscillator. The padder may be made variable to ensure that the oscillator frequency may be adjusted for optimum tracking.

The intermediate frequency generated from the received RF carrier retains the original modulation, so that it can be amplified and passed on to the detector in the usual way.

It is here that the advantage of the superheterodyne principle becomes evident. Since each selected signal is automatically transformed to a constant frequency (which we have assumed to be 455kHz), the IF amplifier channel may be provided with any desired number of circuits, permanently tuned to the selected intermediate frequency.

Coupling coils between valves may have both primary and secondary tuned, instead of the secondaries only, as in ordinary TRF practice. No variable tuning gang is necessary for this purpose, and the coils may be designed for compactness and efficiency, and thoroughly shielded for stability.

Intermediate frequency (IF) tuning circuits were frequently resonated in the past by means of small compression type



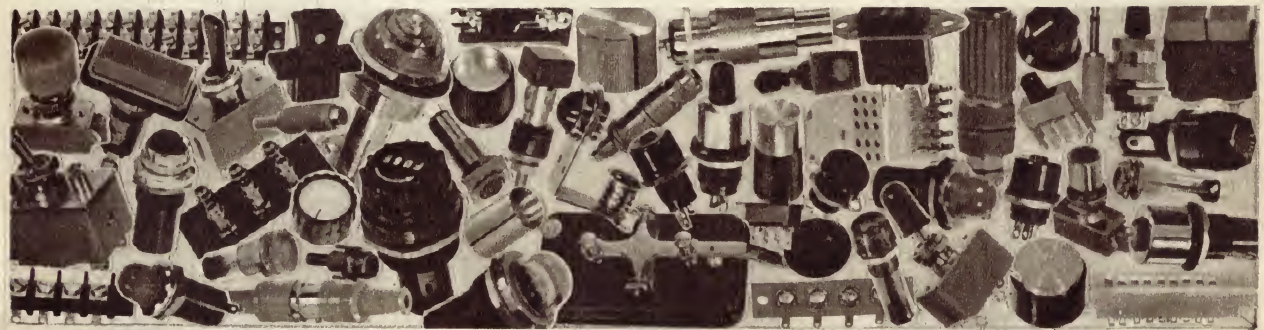
Exterior and interior views of a small "personal portable" transistor receiver. Typical small receivers of this type use the superheterodyne principle, and have from six to eight transistors.

Like being proud of their Kangaroo, Sato's large variety of electrical parts is the favorite choice by Australians. Your inquiries are welcome.

SATO PARTS

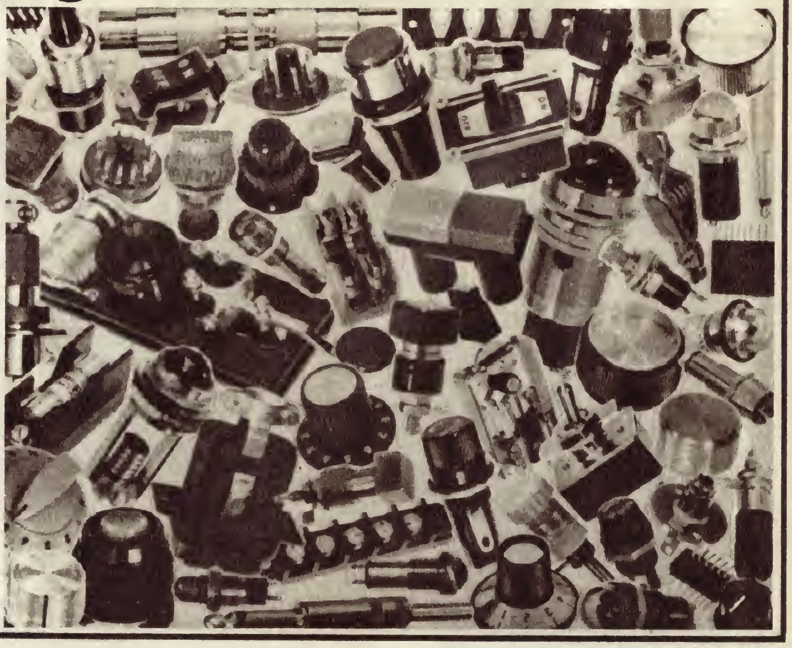
SATO PARTS CO., LTD.

HEAD OFFICE: EBISU, SHIBUYA-KU, TOKYO, JAPAN TEL: (442) 8506~8
BANK ACCOUNT: MITSUBISHI BANK



A vast range of SATO Parts

- For manufacturers
- For TV
- For radio
- For instruments
- For amplifiers
- For kitset builders
- For sound equipment
- For industry
- For stereo equipment
- For educational purposes
- For electronics
- For tape recorders



Distributed by

GENERAL ACCESSORIES

AVAILABLE AT FOLLOWING BRANCHES:

46 Milligan Street, Perth.
116 Clarence Street, Sydney.
81-97 Flinders Street, Adelaide.
50-54 Lt. Edward Street, Brisbane.
443 Concord Rd., Rhodes, N.S.W.
153 Sturt Street, South Melbourne.
Cnr. Ingham Rd. & Echlin St., Townsville.
Homecrafts, Tas P/Ltd. 199 Collins St., Hobart.

mica trimmers, adjusted with a screwdriver. Alternative and common practice nowadays is to have a fixed mica or ceramic tuning capacitor and to vary the inductance of the coil by a small adjustable iron core.

Most ordinary superhets employ one stage of IF amplification, involving two IF transformers, Larger sets may use two IF amplifier valves or transistors with three IF transformers.

These tuned circuits in the IF channel are fully effective in discriminating against unwanted signals.

For example the desired signal may be on 1,000 kHz with an adjacent and interfering signal of 1,010. The single tuned circuit ahead of the mixer valve could not discriminate effectively against a signal only 10 kHz removed from the desired one, so that a substantial 1,010 kHz signal may reach the input of the mixer valve.

In the output of the latter, there would, therefore, be the desired heterodyne frequency of 455 kHz, plus another heterodyne produced by the unwanted carrier at 445 kHz. But, with four or more circuits to negotiate, all tuned to 455 kHz the signal on 445 kHz would have little chance of reaching the detector at troublesome level.

Thus, even though the average domestic superhet uses only a two-gang tuning capacitor, there are generally something like four or five tuned circuits to discriminate against unwanted signals — as against two tuned circuits provided by a two-gang capacitor in the TRF arrangement.

Another reason for improved selectivity in the superhet is the basic fact that the frequency is changed to a lower value. As shown in the example above, the difference in frequency between the wanted and unwanted station — 10kHz in this case — is retained when the frequency is changed. However, relative to 455 kHz, 10 kHz is a greater change, in terms of percentage, than the same change relative to 1000 kHz.

Thus, assuming tuned circuits of equivalent "Q", the one at 455 kHz will be better able to reject the unwanted signal than the one at 1000 kHz. It will also be understood why some circuits use even lower frequencies, 175 kHz and even 50 kHz being employed where very high selectivity is required.

The output from the IF amplifier stage ultimately feeds into a detector, which may be any one of several varieties. The output and power supply arrangements are exactly as for a TRF receiver.

Figure 3 shows the sequence of stages in a typical superhet in block schematic form. The aerial input signal is fed to the mixer or frequency changing stage, where it is mixed with a signal generated by the in-built oscillator.

The resultant or intermediate frequency is then amplified in the IF stage and passed on to the detector, where the audio component is extracted. This is amplified in the audio stage and applied to the loudspeaker.

At first, the functions of mixer and oscillator were entirely separate, as indicated.

The mixer was normally operated under very high bias conditions, as employed for a detector. Hence, the mixer valve in these early superhets was commonly referred to as the "first detector." The normal detector for demodulation naturally gained the title of "second detector."

In the inevitable trend to simplification, it was found possible to obviate the separate oscillator valve, and the first detector was made simultaneously to fulfil the function of oscillator by connecting it to the oscillator tuned circuit.

This arrangement, employing generally the 57 or 6C6 pentode, was widely used around 1932. Known as the "autodyne" circuit, it proved quite efficient and adequate until the demand for dual-wave sets emphasised its non-suitability for such receivers.

Ultimately, the trend to superhet circuits, the popularity of dual-wave receivers and adoption of automatic volume control, led to the evolution of special valves for use as frequency changers. These varied a good deal in structure from one type to the next, but normally had a triode oscillator and a screen-grid mixer section within the one envelope.

Examples of more elaborate receivers. These are generally double or triple conversion superhets, with a variety of additional features.

With the advent of transistors, the autodyne principle has been revived with the first transistor acting as both local oscillator and mixer.

In fact a modern "pocket portable" transistor radio illustrates very well how the superhet has been developed and simplified. Typical receivers of this type use only six transistors: one as an autodyne mixer, one as an IF amplifier, and the remaining four in the audio amplifier. The "second detector" function is generally performed by a germanium diode.

Receivers intended for specialised communications work invariably use the superhet principle, because of the high gain and selectivity which it offers. In many of these receivers more than one intermediate frequency is used, with a number of mixers used to change the frequency of the signals from one to the other. Thus one can have a "double-conversion" receiver, a "triple-conversion" receiver, and so on.

Many such receivers use special filter units in their IF amplifiers, to achieve either a very sharp selectivity response or a carefully adjusted wider response. There are a variety of such filter units available with names such as "crystal filter", "mechanical filter", and "ceramic band-pass filter".

The provision of these and other facilities at the fixed intermediate frequency is something which could not reasonably be duplicated in any TRF design.

At the same time, most high performance superhet receivers do use at least one RF amplifier stage ahead of the frequency changer. An RF stage ahead of a superhet circuit makes a minor contribution to gain and selectivity and also helps exclude from the frequency changer strong signals at frequencies remote from the desired station. In special circumstances such signals may cause spurious beats with harmonics of the local oscillator and penetrate the IF channel.

An RF stage also tends to have a lower inherent noise level than a mixer. By amplifying the incoming signal somewhat before its frequency is changed, a more favourable signal-to-noise ratio can be obtained.

Modern television receivers also use the superhet principle. The problem in this case is not to get extreme selectivity but a specific amount of selectivity — no more and no less. To meet this requirement in the variable tuned circuits of a TRF would be very difficult but in the IF channel of a superhet it can be provided without any specially difficulty. Five or six tuned circuits are often used for this purpose.

Elementary Electronics

An Electroscope

by Ross Tester

Most science students will be familiar with the electroscope — a device using very thin metal foil to detect the presence of static electricity. Here is a modern version — using solid state techniques and a moving coil meter.

We described a conventional electroscope in February, 1970 (File No 8 / C / 15). Copies of this article are available for those who may not have the issue. As well as describing how to construct the device, the article lists a number of experiments which can be conducted. This article would make good background reading for those who wish to construct this version of the electroscope.

Our new electroscope is quite a jump from the simple concept of the original electroscope which, incidentally, was among the first primitive measuring devices with which the pioneers laid the foundations for our present electronic technology. This latest version uses one of the most recently developed solid state devices — the FET — in a simple bridge circuit to produce an extremely sensitive device.

The bridge circuit may be a new concept to many readers, but is a most important circuit configuration. Furthermore, it is not particularly difficult to understand. It has many uses, ranging from direct measurement of resistance, capacitance etc, to industrial control circuits. In our present circuit we make use of its balanced condition to balance out, or cancel, a heavy standing current, which would normally overload our sensitive indicating meter.

To understand this better let us look at a basic bridge circuit. As shown in the diagram, it consists of four resistors; Ra, Rb, Rc, and Rd. In bridge terminology, Ra and Rb form one "arm" of the bridge. Rc and Rd form a second "arm".

If a voltage is applied between points X and Y current will flow through two paths; through Ra and Rb, and through Rc and Rd. The amount of current flowing in each arm will depend on the values of the resistors. Let us take an example.

Suppose that Ra is 20 ohms, Rb is 100 ohms, Rc is 100 ohms and Rd is 20 ohms. Note that the ratio between Ra and Rb is the same as the ratio between Rd and Rc. While ever these ratios are equal the bridge is said to be balanced. The two arms need not have the same values of resistance, provided the ratios are equal. For example; Ra and Rb could be 2 ohms and 10 ohms, or 40 ohms and 200 ohms, just so long as the ratio (five to one in this case) is the same.

If we assume a specific value of voltage applied between points X and Y we can work out the current in each arm, using Ohm's law. Suppose we connect a 12V battery between X and Y.

The total resistance of the right arm (Ra, Rb) is 120 ohms. Ohm's law says that the current flowing through a resistor is equal to the voltage applied to the resistor, divided by its resistance. ($I=E/R$) From this we find that 0.1A flows through this arm. Since the other arm has the same resistor values, it will also have a current of 0.1A flowing through it.

Having found these current values we can now work out the voltage across each resistor, again using Ohm's law. Transposing the formula we get $E = I \times R$. From this we find that if 0.1A is flowing through a 20 ohm resistor, there must be 2V applied to the resistor. Similarly, 0.1A through a 100 ohm resistor means that 10V is applied to the resistor. (Note that these total 12V, the voltage applied.)

Now we come to the crux of our discussion. With reference to point X, point O is 2V positive. Also, since the other arm (Ra, Rb) has the same ratio, point P will also be 2V positive with respect to point X.

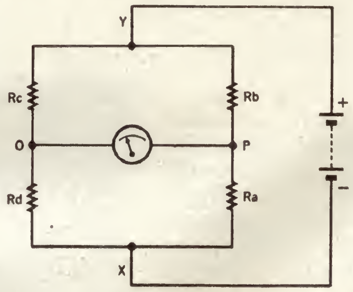
Since the indicating meter is connected between points O and P, and these two points are at the same potential, there will be no reaction by the meter. In this condition the bridge is said to be balanced. The important characteristic of this setup, as far as we are concerned at the moment, is that, even though current flows in each arm of the bridge, none of it is registered by the meter while ever the bridge is balanced.

However, if anything should happen to cause the value of any one of the four resistors to change its value, the voltages at points O and P will no longer be identical, and the meter will read. Thus, while the meter will not respond to a normal standing current, it will immediately respond to any change of current.

Now take a look at the circuit of our electroscope. Notice the similarity? In place of Ra and Rb we have a 47K pot which,, because of the tap provided by the moving arm, can really be regarded as two resistors, both variable. In place of Rc we have a 2.2K resistor, and in place of Rd we have the source / drain path of the FET. The meter and battery connections are as before.

From what we have already explained it should not be too hard to visualise this circuit in a balanced condition. When the FET is in its "quiescent" state (no voltage between gate and source) its resistance is quite stable. When we adjust the tap on the pot so that the upper and lower halves of this arm have the same ratio as the 22K resistor and the source / drain resistance of the FET, the bridge is balanced and the meter reads zero.

Because of the balanced condition we can use the most sensitive indicating meter we



Above: The basic bridge circuit around which our electroscope is designed.

Right: The completed detector on its perspex base. The 2.2K resistor is obscured by the pot. Note our simple off-on switch; a loop of wire shaped to catch the battery lead when bent over it.

like, regardless of the current required by the FET. For example, we could use a 50uA meter, even though the current through the FET is more likely to be around 15mA.

A meter of this sensitivity will detect an extremely small change in the bridge. Because the change is likely to be an amount which is enough to send the needle hard FSD (full scale deflection), we suggest you use a lower sensitivity meter — around 1mA.

Now, how does the electrostatic charge upset the balance of the bridge? Whenever any body or mass is charged, there will be an electric field associated with the charge. This field radiates from the body, getting progressively weaker as it moves further away.

If a capacitor is placed in this field, the capacitor will become charged. It will lose the charge as soon as it is removed from the field.

Our static electricity detector is virtually a capacitor. On one side we have the detection rod, on the other the wiring of the bridge. And between these two "plates" we have the gate and source electrodes of the FET.

Now bring a charged mass into close proximity to the rod. As the capacitor is now charged, there will be a potential difference between its two plates — and between the gate and source. This changes the resistance of the FET, upsets the balance of the bridge, and deflects the meter.

If we were to actually touch the rod with some charged objects, it is possible that quite a large current might flow into the gate. This current could, conceivably, be large enough to damage or destroy the junction of the FET by overheating it. For this reason, we have taken the precaution of covering the rod with PVC tubing, to prevent accidental touching.

In the interests of economy, we are not suggesting you buy a meter just for this project. Rather, we hope that by now most, if not all, of the readers of the Elementary Electronics section will have obtained a multimeter. If you have not, now is a very good time. For here is one time when you can put the "uA" and "mA" ranges of your meter to work.

Most modern multimeters are of the 20,000 ohm per volt variety. That is, they have a basic movement of 50uA. Meter shunts are used to enable you to measure higher currents — some go as high as 10 amperes or more.

But we are more concerned with the ranges between 50uA and around 50mA. These will be the most useful in the bridge. To save "bashing" the meter, it is best to start on a high mA range, and work down.

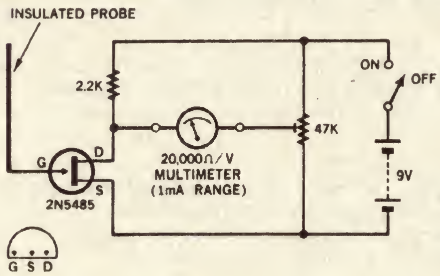
The ranges mentioned should enable you to obtain quite high sensitivity with your detector. If you do not have a multimeter, but do have a meter with an FSD current somewhere around 1mA, by all means go ahead and use it.

We built our detector on a piece of ⅛in perspex. We did this for two reasons: the first, perhaps the most important, is that perspex has extremely low electrical leakage — in other words, it is very nearly a perfect insulator. If we built it on, say, a piece of wood, our sensitivity would be poor because a portion of the charge would leak away through the wood. This would be particularly so on a humid or rainy day.

The second reason was that clear perspex will allow those not familiar with electronics to see the wiring through the perspex. This will help to demonstrate electronics to others — especially if the builder is a science student or teacher who wishes to demonstrate the device to others.

If the second reason does not apply in your particular case, there is no reason at all why you should not build the detector on some other base. Just keep in mind our comments on leakage.

Our base measured approximately 8in (203mm) by 3½in (89mm). We used four circles of perspex as feet, by glueing them to the underside. You could use four small rubber feet if desired. The FET, potentiometer, resistor and battery were all positioned at one end of the base. The rod, as can be seen in the photograph, is joined to the gate of the FET by a single piece of tinned copper wire.



The circuit of the complete electroscope. Compare it with the bridge circuit on the opposite page.

We put our components on the perspex in the position we thought best, and then marked the positions of the leads with a fine tip felt pen. The position of the battery was also drawn, to enable us to make a battery holder later.

We then drilled the holes with a number 58 drill. This is the size which is normally used for printed circuit boards — component leads fit through easily. The holes for the potentiometer will have to be slightly larger — say 1/16in. When the components are soldered, the heat on the leads causes some of the perspex to melt, thus holding the components in place.

One point we might make — when marking the positions for the holes to be drilled, do not use a pencil! This could leave a fine layer of graphite (pencil "lead") on the perspex. And since graphite is a conductor (one of the forms of carbon) the whole purpose of using perspex could be defeated.

Two spring terminals were used to connect the detector to the multimeter. These were fastened in place by drilling two holes, each just smaller than the threaded shaft of the terminal, and then forcing the terminals into them. They cut a thread in the perspex as they screw in.

The detector rod was made from a piece of 16 gauge tinned copper wire, bent double and soldered together. To fix it in place, we drilled a hole just large enough to fit the double wire, and forced it in. Then we turned the base over, and ran some solder over the ends of the wire. Once again, the perspex melted, firmly fixing the probe in place. We then cut off the excess protruding from the bottom, and soldered the wire from it to the gate.

To finish off the rod, we slid a length of insulating tubing over it, and sealed the top by touching it with a soldering iron. You could use any piece of plastic — even a drinking straw will do.

We made simple wire holders for the battery, by drilling four holes alongside it and then tightening some thin wire around it with a pair of fine pliers. Note that you will need a battery connector if you use the same battery we did.

We made a few experiments with our detector to determine how sensitive it was, and were mildly surprised. A plastic bag, waved around from across the other side of our laboratory, caused a large deflection on the meter. If we moved any closer, we had to use a higher scale on the meter to stop it banging hard against the restraint at the end of the scale.

A comb, brushed through one's hair a few times will cause a full scale deflection, as will a piece of plastic rod rubbed on cloth.

As with a conventional electroscope, the weather has a marked effect on sensitivity. If it is a humid or rainy day, the readings will be less than those made in the same way on a dry, hot day. This is because the charge is able to leak away through the air, due to the amount of water vapour in it.

One fine, warm day, we turned the detector on, and found that nothing would induce the pointer to move from the stop at the bottom end of the scale. So we reversed the meter connections, and found that the pointer now pressed hard on the other stop. Turning the pot through its full range had no effect — it was not until the meter was put on the 50mA range that the pointer dropped a little.

We finally worked out that the author's

shirt was causing the trouble. Apparently the material, a synthetic, had developed a very high potential during the day, and this potential was opposite to that of the other devices we had experimented with. For quite a few days before, it had been raining, and this affected the detector. On this particular day, however, the meter registered a high negative deflection.

This brings us to an important point — if the meter deflects in the opposite direction you will have to change over the meter connections. The reverse reading indicates a reversal of polarity on the "capacitor".

When a plastic rod (or ballpoint pen or ruler) is rubbed on a piece of cloth, heat is produced by friction where the two surfaces are in contact. The heat imparts extra energy to some of the electrons associated with the atoms in the two surfaces, allowing them to move a little more freely from atom to atom. They may even leave the parent material altogether.

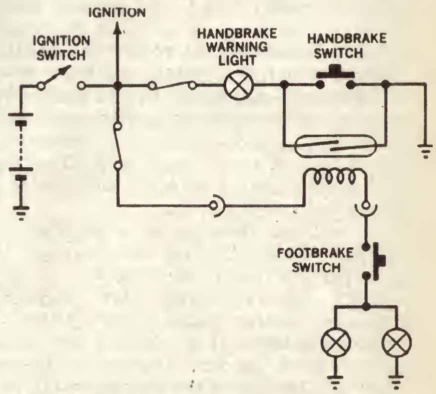
In fact, with certain materials such as plastic and cotton or wool cloth, quite a lot of electrons transfer from the cloth to the plastic surface. The plastic, therefore, ends up with a large surplus of electrons and, therefore, a substantial negative charge. This charge will remain for quite a long period, because the insulating qualities inhibit the charge from leaking away.

By contrast, glass tends to lose electrons to a piece of cloth (particularly silk) on which it might be rubbed. Therefore, the glass acquires a positive charge and the cloth a negative charge. Even the human body can acquire a charge — but this is generally small and insignificant because of the leakage to the ground and to the air. You may notice, though, that the meter will deflect slightly when a person comes close to the pickup rod.

We could say a lot more on the experiments and observations possible with the electroscope. However, time and space does not permit this. We suggest that you try the things we have mentioned, and, if possible, repeat the experiments with a conventional foil electroscope, to compare the results. You may be able to get a few hints from a science teacher or textbook.

Improved Brake Light

Since presenting the Brake Light Warning System on these pages in the March issue, we have had the opportunity to consider it in relation to a wider range of vehicles. As a



result, we have evolved a circuit which permits the handbrake warning light to double as a stop light indicator without the

Elementary Electronics: Ideas Worth Trying

A Remotely Controlled Variable Resistor

There are many situations in which a remotely controlled variable resistor would be extremely useful. A typical one would be where it was desired to control an audio signal from a remote point, but where it is impractical to bring the actual audio circuit to the control point. Many similar applications will suggest themselves.

Such a device is relatively easy to make and, as described, has the marked advantage that the variable resistor is completely isolated, electrically, from the control circuit.

The assembly described in the text. It is based on a standard 7 pin shielded valve socket, with the LDR mounted in the socket proper.

The heart of the device is a light dependant resistor (LDR), which is optically coupled to a small filament type lamp. By varying the brilliance of the lamp, using a variable resistor in series with it, the resistance of the LDR can be varied from a few hundred ohms to several megohms.

A typical LDR is the ORP12 (or ORP15) while the lamp can be one of the several dial lamps available, according to the supply voltage and the brightness range required. A good all round choice would be the popular 6.3V, 250mA type. This lamp can be effectively controlled by a 50 ohm wire wound variable resistor, which should have a dissipation rating of two watts over the whole element.

A practical form of such a device is shown in the accompanying photograph. Basis for the assembly is a 7 pin shielded valve socket. The socket provides a convenient mounting for the LDR, the lamp is mounted in the end of the shield, and the complete assembly is virtually light tight.

The pin spacing of the LDR is similar to that between any two diametrically opposed socket pins. The LDR pins are too thin to fit the socket but, if bent double, they make a neat fit. However, they should not be forced into a new socket. Fit an old valve and rock it around a little to open the pins slightly.

The lamp may be held in the end of the shield by simply pushing it into a suitable size grommet already fitted, the leads being soldered directly to the lamp.

Ideally, the lamp should operate from DC, since there is then no possibility that the LDR will be modulated at 100Hz, as will be the case if the lamp is operated from the 50Hz mains. On the other hand, the system is surprisingly tolerant to AC. This is partly due to the thermal lag of the lamp filament, and partly due to the relatively slow response of the LDR. However, this response time varies with the light level involved.

If the control function does not involve signal circuits, there may be no objection to the use of AC. Where signal circuits are involved, the level will probably determine whether AC can or cannot be used. As an example, the idea has been successfully used as a variable contrast control between a video detector and video amplifier, without any AC modulation being obvious. On the other hand, very low signal levels would make a DC supply essential.

Brake Light — Cont.

need for the isolating diode. This makes the system just about as cheap and simple as one can imagine, yet retains the professional appearance of the car dashboard.

The accompanying circuit shows how it is done. While car electrical systems may vary in minor details, it should be possible to adapt it to most models. Basically, the reed connections are separated completely from the energising coil and simply connected in parallel with the handbrake switch. The coil is connected in series with the stop light circuit as before.

Some stop light circuits are activated only when the ignition switch is on, others will function at all times, regardless of switch settings. With the circuit as shown, unwanted voltages cannot be applied to the ignition or other circuits regardless of the switching arrangement used.

The actual method of connection to the handbrake switch will vary according to the car. In cars having handbrakes mounted under the dashboard, access to the switch is usually simple. Those having floor mounted levers often have the switch under the floor, in which case it may be easier to pick up the circuits somewhere else. For example, using the accompanying circuit as a guide, one connection could be to the appropriate side of the warning light, and the other to the chassis.

Finally, the installation illustrated in the March issue has already justified itself. A few weeks after it was fitted it indicated a fault, which turned out to be a burnt out globe in one stop light.

Portrait of a man doing the impossible

Peter Mucini listening to stereo. Everyone of him. And everywhere he sits the stereo is great. It's impossible. That's right.

Because Peter Mucini is listening to Sonab. And Sonab has done what everyone said was impossible.

Created by Stig Carlsson, Professor of Acoustics at the University of Stockholm, the Sonab speaker system is omnidirectional.

It's the first that has really worked.

It fills a whole room with stereo sound. (Instead of that one short static line you get from conventional forward facing speaker systems.)

So wherever you're sitting, whatever you're doing, you're surrounded, immersed, almost drowned in rich true stereo sound.

No other system in the world will give you that. But what's the use of talking.

The only way to really appreciate the staggering difference is to listen to it. At your local Sonab dealer.

Write to us for his name and address.

Sonab

Sonab of Sweden Pty. Ltd., 114 Walker Street, North Sydney, NSW 2060. Telephone: 929 4288/4554.

CLASSICAL RECORDINGS

Reviewed by Julian Russell

Bohm's Salome: "rare delicacy"

STRAUSS (Richard) — Salome. Complete Opera. Richard Cassilly (Herod); Mignon Dunn (Herodias); Gwyneth Jones (Salome); Dietrich Fischer-Dieskau (Jochanaan); Wieslaw Ochman (Narroboth) and others with the Hamburg State Opera Orchestra conducted by Karl Bohm. DGG Stereo 2707 052. Two Discs.

Bohm's reading of this opera is often one of rare delicacy which lends irresistible charm to many of the more lyrical passages. Even in the first bars you realise that you are to hear an entirely different interpretation from Solti's fine Decca set. The poetic references to Salome by the soldiers, Salome's entrance — a little unsteady at first but gaining confidence as she gets into the skin of the part — and the musings of Narraboth all enchant the ear. Later, however, where the music becomes much more forceful as the drama develops Bohm seems altogether too gentle. Salome becomes almost coquettish when she refuses to dance for Herod, hinting at none of the obscenities that fill her mind.

In the Dance of the Seven Veils the orchestral playing is very restrained at first, gracefully sinuous rather than explicitly erotic. It is an unusual performance that grows on one with repetition, certainly the most refined I have ever heard. But if you're looking for the punch you have in the Solti set you will be disappointed. Yet Bohm's whole reading is valid when it is remembered that Salome was little more than a child and there is a good deal of the precocious teenager in Bohm's treatment which concentrates on this angle rather than in presenting her as a grown woman of unmatched evil.

The orchestral accompaniment to Herod's efforts to persuade Salome to accept limitless riches instead of the head of John the Baptist is quite marvellously presented. When he talks of his white peacocks and his jewels the orchestra is aglitter with luscious sounds. There is, too, heart catching drama when Salome awaits John's execution, and Jones is at her most expressive when she apostrophises the severed head. But it is later, when the music steadily mounts into its overwhelming climax that she lacks the mature resources of Birgit Nielsen, the Salome in the Solti set.

By now most record buyers know and allow for DGG's tendency to favour the voice at the expense of the orchestral accompaniment and for that reason will not be surprised that occasionally some orchestral detail is obscured by the vocal line. This is most noticeable in the John the Baptist music which Fischer-Dieskau delivers like a fire and brimstone street-corner preacher. Even when he retreats to the bottom of his well he still thunders like an Old Testament prophet — which, of course, he was — but there is too little perspective in the recording of this scene.

I enjoyed Richard Cassilly's performance as Herod, no weakling slobbering inanely but a strong man drunk on alcohol and lust. The complex music of the quarrelling Jews is brought off with skilful clarity, and all the minor parts, especially Mignon Dunn's vicious Herodias crowing in triumph, are splendidly played. But whatever your opinion of Bohm's interpretation of the opera the sheer vitality of Strauss' score compels your involvement. He bludgeons you into suspending critical faculties. Your attention remains rivetted even when your mind dictates disapproval. But one detail did really let me down. After the terrific build-up of the final scene, the final heavy chords in C Minor have a strangely dead, dry sound, quite unlike the peremptory conclusion Strauss imagined and Solti realised where the ancient world is cut off by the fall of the curtain and one returns, in one giant step, emotionally exhausted, to the 20th century.

★ ★ ★

MOZART — The Marriage of Figaro. Complete opera. Ingvar Wixell (Count Almaviva); Jessye Norman (Countess Almaviva); Mirella Freni (Susanna); Wladimiro Ganzarolli (Figaro); Yvonne Minton (Cherubino); Maria Casula (Marcellina); Clifford Grant (Bartolo); Robert Tear (Basilio) and others with the BBC Symphony Orchestra and Chorus conducted by Colin Davis. Philips Stereo 6707 014. Four Discs.

Colin Davis' views on Figaro are unusual but indisputably valid. Whether or not you enjoy his performance will depend to a large extent on your open-mindedness. But the set under review, in terms of tempos, ensemble, soloists, and orchestra will be found hard to match. The chief difference between Davis' reading and that of most other conductors is that Davis, while never overlooking any opportunity to bring out every aspect of the comedy, also stresses the serious import of a play that is supposed to have had a considerable influence — among, of course, many others — in sparking off the French Revolution.

The places where he introduces these profoundly perceptive moments amidst all the surface frivolity are too numerous to mention in the space I have here. But again I hasten to add that he never sermonises. It is all done with quite magical deftness, and without impeding the natural, sparkling flow of Mozart's inspired music. Having pointed this out, all too briefly, alas, I can go on to say that vocally the set is unsurpassed in its precision and expression. You will hear no wobbly vibratos but, on the contrary, voices focused to an unwavering accuracy of pitch and production. The whole cast is so impressive that it is difficult to select any members for special mention but the performances that remain most vividly in the memory are Ganzarolli's Figaro and Jessye Norman's Countess.

There is, too, Ingvar Wixell's aristocratic but fervent Count, Yvonne Minton's youthful but assured Cherubino and Mirella Freni's beautifully sung Susanna, whose occasional seriousness in no way inhibits her general sense of coquettishness. A deliciously fragile-toned but clear harpsichord supplies the continuo and the sensitively controlled stereo separation aids vastly in the identification of the various characters during complex ensemble scenes. The orchestra provides constant joy in its precise pointing, exhilarating rhythms and the subtlety of its untiring nuancing.

You may be surprised to hear the famous aria "Dove sono" sung before, and not after, the Sextet, but there is nowadays a considerable body of opinion to support this transposition. You may also notice that Davis, in his treatment of the recitatives, makes it quite clear which are purely conversational and which should make its point to the audience. On the vexed question of appogiaturas Davis follows a middle line, avoiding cut-off endings but sparing in their use elsewhere. I could go on for pages lauding the freshness and beauty of this memorable set which I think, should interest all Mozart lovers, even those who already own a favourite performance previously recorded. I can only urge you to acquire it and enjoy it yourselves.

★ ★ ★

HONEGGER — Symphony No 2 for Strings. Orchestre de Paris conducted by Charles Munch.

MESSIAEN — Et Expecto Resurrectionem Mortuorum. Orchestre de Paris and the Percussion Ensemble of the Orchestre de Paris conducted by Serge Baudo. Record Society Stereo S / 6400.

Generally speaking the late Charles Munch was not one of my favourite conductors. I remember him when he visited Australia with the Boston Symphony some years ago driving them like a drill sergeant through a program which included Berlioz Symphonie Fantastique. In the middle 1960s I heard him conduct, in Paris, a French orchestra in a tribute to Debussy and was again disappointed. But in the Honegger recorded here, one of the last recordings Munch made, he is in a different mood altogether. The symphony was written in Paris the year after the fall of that city during the last war and opens in a mood of unrelieved despair most sensitively presented by Munch. If it fails to move you, you must be very hard hearted indeed.

After the sombre opening you have a thumping theme inspired perhaps by the tramp of jackboots marching down the Champs Elysees. The movement hovers between these contrasting moods with never a bar's release from tension. The second movment is an anguish-laden

lament, seeking relief but never finding it. It is soul lacerating music and the Orchestre de Paris has never played better. The Finale is more hopeful even if that hope is never quite realised. Rather, distraction is sought in physical activity. A trumpet is added towards the end to support one of the many polyphonic lines in the strings and, when it plays, hope really seems within reach of fulfillment. And the year was still 1941. This string symphony is a most eloquent work, most eloquently played.

The Messiaen work features the same orchestra but this time under the baton of Serge Baudo, in my opinion the best French-born conductor working in France today. I found one curious fact in Messiaen's sleeve notes. He states that "the scoring intends it for vast spaces." Yet its first performance was given in 1965 at the Sainte-Chapelle in Paris and there is nothing vast about this small Gothic gem situated on the Ile de la Cite. However, listening to it as presented on this massively vivid recording one can appreciate what the composer had in mind.

It is in five sections, each inspired by a Biblical text. The first is taken from the 130th psalm — "Out of the depths I have cried to thee, O Lord," — a truly agonised cry for Divine mercy. The second section, "Christ being raised from the dead. . ." (Romans 6, verse 9) is in a mood of contrasting serenity and peace featuring mostly unaccompanied woodwind solos. Later comes a characteristic interlude with a background of tuned percussion, then a return to the woodwind solos, this time lightly accompanied. In this movement much dramatic use is made of silence.

Section 3 "The Hour is coming when the dead shall hear the voice of the Son of God" (John 5:25) offers some more characteristic Messiaen sound — that of bird song. The whole is so highly coloured in its opposing solemn statements that a description would take many pages. The fourth movement, "They shall be raised in glory" (1 Corinthians, 15:43) is introduced with the menace of gongs strokes against the jubilation of a lark's song that reminded me of the Flecker poem, "Tenebris Interlucentem." The finale, a song of praise by the Saints "And I heard the voice of a great multitude" (Revelation 19:6) features prominently the always sinister tritone at the beginning, then goes into rapturous praise that carries one with it to intoxocating heights, believer and sceptic alike.

I should like to point out that if you know your way around Messiaen's music — and perhaps even if you don't — you won't find any great problems of appreciation of this music even at first hearing. The whole production is a very moving disc of music superbly played and recorded. But a word of warning — it is intended only for the serious.

★ ★ ★

SCRIABIN — Le Poeme de l'Extase. TCHAIKOVSKY — Romeo and Juliet. Boston Symphony Orchestra conducted by Claudio Abbado. DGG Stereo 2530 137.

In the wrong hands, which allow the composer to seemingly hypnotise himself by contemplating his chromatic harmonisations — and mystic chords, theosophy and other quaint conceits — Scriabin's Poeme of Ecstacy can wander about pointlessly. The music rises and falls, gathers tumescence and fades way without orgasmic release. Repetition

follows repetition, each usually a little louder than the last, straining ever upwards — to nowhere. Abbado, however, stiffens the skeletal foundation more than I could have imagined possible but without impairing the sweet chromaticism of its fleshings. There is no flabbiness. He is never afraid to let his trombones crackle, his trumpets proclaim their unsatisfied yearning, The engineering is superior to that of any other recording of the work I have heard, and the Boston plays the music superbly. Abbado achieves scarcely bearable tension throughout and if it all dribbles away to nought that is the fault of the composer and not the fine orchestra. Even when the work reaches its final destiny, firmly anchored in the harbour of C Major, it could easily start all over again with the same effect of incompletion. In the meantime you have heard some beautiful, hazy musical thoughts — despite the assertive brass — and some throroughly enjoyable playing.

The Tchaikovsky piece has nothing in common with the Scriabin except in its Russian nationality. Tchaikovsky always knew where he was heading and Abbado sees his final destination clearly from the first bars. He gives the work an impressively grave introduction of rare dignity. His touch of Slavic melancholy is in no way out of place. Later in the intro he develops intensity — just before the allegro — and perhaps just a hint of perfervour. But once embarked on the fast section he pushes it along with great energy. Later still you have some lovely legato playing of the great love theme — surely one of the most beautiful melodies ever written — which transforms the theme into one long cantilena. Then comes vivid conflict with even the frequent use of clashing cymbals skilfully avoiding vulgarity.

Abbado's is a beautifully balanced account of the work, recorded with sumptuous sound. The quality of the Boston strings is quite wonderful. I know of no better current recording.

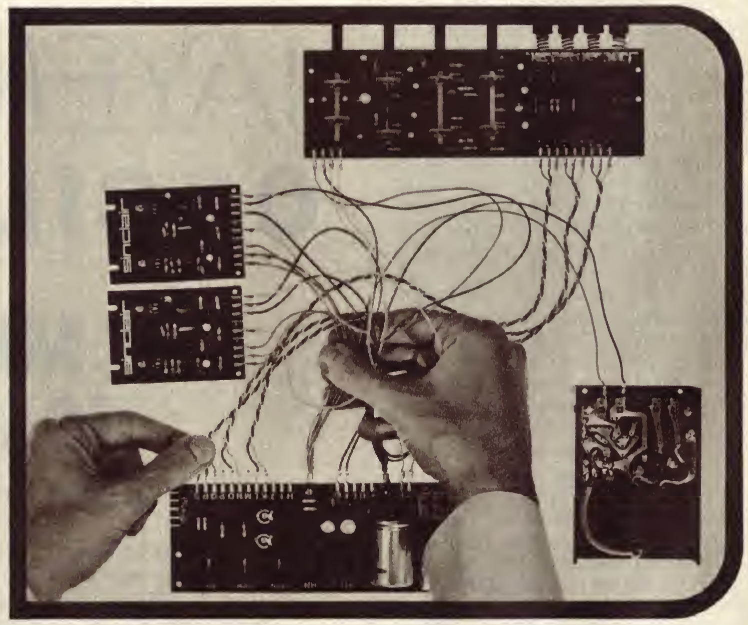
★ ★ ★

IRELAND — Orchestral Masterworks, Vol. 1. A London Overture. Epic March. Concertino Pastorale. A Downland Suite (Minuet and Elegy). The Holy Boy. London Philharmonic Orchestra conducted by Sir Adrian Boult. World Record Club Stereo S / 4397. Orchestral Masterworks, Vol. 2. Symphonic Rhapsody Mai-Dun. Prelude, The Forgotten Rite. Legend for Piano and Orchestra. Overture "Satyricon". London Philharmonic Orchestra conducted by Sir Adrian Boult. Eric Parkin (piano). WRC Stereo S / 4398.

John Ireland (1879-1962) was an English petit maitre of considerable skill and good taste once famous among those only mildly interested in his other music by his setting of John Masefield's poem, "Sea Fever." The bulk of Ireland's music was unfailingly pleasant if seldom memorable, like most of the other music written by the more timid of the English composers working during the 1920s and 30s. His orchestral pieces show a nice sense of colourful scoring of the more conventional kind.

The city of London has inspired many British composers — the two most notable to come to mind are Elgar (Cockaigne) and Vaughan-Williams (A London Symphony). Ireland's London Overture follows much

The do it yourself amplifier for non-technical people who hate soldering irons.



(The Sinclair Project 605)

The Sinclair Project 605 is a ready-to-assemble 30 watt hi-fi stereo modular amplifier containing the new Masterlink connector unit.
The Masterlink is the heart of your Project 605. All inputs and outputs are routed through it by colour coded, push-fit, ready tagged wires.
There's no messy soldering, nor professional skill required.
Simply follow the instruction manual provided, which shows in full size working diagrams, each step.
The Sinclair Project 605 Amplifier Kit comprises 2 power amplifiers, pre-amplifier/control unit, power supply, Masterlink connector unit, instruction manual and all tagged wires.
It's the simplest, most economical way to the world's finest high fidelity.
Ask your Hi-Fi dealer now or send coupon for full particulars.

GOLDRING

Engineering (A'asia) Pty. Ltd.

New South Wales: 26 Ricketty Street, Mascot 2020. Telephone 67 6088. **Canberra:** 19 Molonglo Mall, Fyshwick, A.C.T. 2604. Telephone 95 8248. **Victoria:** 162 Pelham Street, Carlton 3053. Telephone 347 5177. **Queensland:** 32 Balaclava Street, Woolloongabba 4102. Telephone 91 4972. **South Australia:** 207 Flinders Street, Adelaide 5000. Telephone 23 3488. **Western Australia:** 32 Northwood Street, Leederville 6007 Telephone 8 4988.

For further obligation free information and technical literature clip coupon and post to your nearest Goldring office.

Name ....

Address ....

I require information on ....

make a big hit!

(With Goldring Hi-Fidelity Tapes)

On top of every sound hit parade is the Goldring range of quality magnetic recording tapes and cassettes. Goldring gives you the superb sound reproduction your system deserves. Goldring tapes are available in every length from 150′ to 4,800′, in 3″, 5″ and 7″ widths: Acetate, polyester and polyester tensilised. With an easy-to-read index card. The Goldring cassettes are available in plastic dust-free packs of 60 or 90 minutes, also with an easy-to-identify index card.

Look for the Goldring accessories display at your local electrical or hi-fi store.

GOLDRING
Engineering (A'asia) Pty. Ltd.

New South Wales: 26 Ricketty Street, Mascot 2020. Telephone 67 6088. **Canberra:** 19 Molonglo Mall, Fyshwick, A.C.T. 2604. Telephone 95 8248. **Victoria:** 162 Pelham Street, Carlton 3053. Telephone 347 5177. **Queensland:** 35 Balaclava Street, Woolloongabba 4102. Telephone 91 4972. **South Australia:** 207 Flinders Street, Adelaide 5000. Telephone 23 3488. **Western Australia:** 32 Northwood Street, Leederville 6007 Telephone 8 4988.

For further obligation free information and technical literature clip coupon and post to your nearest Goldring office.
I require information on **Goldring tapes**

Name...

Address...

3 SIMPLE STEPS TO RECORD PLAYING SUCCESS.

1. INVEST IN THE BEST TURNTABLE AVAILABLE. THORENS

Choose from the Model TD-125 or the TD-150 Mk. II. Then you can share the opinions of leading overseas reviewers: *"the best three-speed manual we've ever tested"* — ("High Fidelity"), *"wow and flutter were as low as we've ever measured"* — ("Stereo Review"), *"a favourite contender in the best turntable category"* — ("Audio"), *"it would be hard to imagine a unit that performs better"* — ("Electronics World").

Examine Thorens specifications closely and critically. The new Model TD-125 features: ● Transistor governed 16-pole synchronous motor ● ±2% speed control on all speeds ● Belt drive ● 7½ lb. 12" turntable ● Wow and flutter ±0.08% ● Rumble —68dB. ● Fine Swiss craftsmanship.

The lower priced Thorens TD-150 Mk. II offers: ● 16-pole synchronous motor ● Belt drive ● 7 lb. 12" diameter turntable ● Two speeds — 33⅓ and 45 rpm ● Wow and flutter ±0.09% ● Rumble —65 dB.

When you've purchased your Thorens turntable . . .

2. ADD AN ORTOFON M15 STEREO CARTRIDGE.

After many years research, Ortofon have designed a new stereo cartridge which maintains the proud traditions of the Ortofon name. Featuring new principles, the high performance standards which have made Ortofon world famous have been preserved in the new Series M15 and MF15. Over 80% of professional users such as the radio and television stations (and recording studios) specify Ortofon equipment.

BASIC SPECIFICATIONS:

Weight of cartridge: *5 grams.*
Frequency response: *20 Hz. to 10 kHz. ± 1 dB.*
20 Hz. to 20 kHz. ± 2 dB.
Recommended load: *47 k ohms.*
Channel separation at 1 kHz. *Greater than 30 dB.*

Having equipped yourself with a fine player and cartridge . . .

3. KEEP YOUR RECORDS CLEAN WITH WATTS EQUIPMENT.

Airborne dust and dirt are the greatest enemies of your records and cause untold amounts of noisy interference.

We recommend:

THE WATTS "DUST BUG" . . . which cleans the record, removing dust and static charges as the record plays. Surface noise is reduced considerably.

THE WATTS "DISC PREENER" . . . designed expressly for records which have not had previous anti-static treatment. The "Disc Preener" keeps new records like new.

THE WATTS "MANUAL PARASTAT", Model Mk. IIA. . . . is a dual purpose record cleaner designed to maintain new records as new and to restore fidelity to older discs.

Ask for a copy of the Watts Guide to Record Cleanliness when you visit your record store.

**It's easy to follow the Three Steps to Success. Call at your nearest franchised Simon Gray dealer's showroom. He'll be delighted to tell you all about Thorens turntables, Ortofon stereo cartridges and Watts record cleaning equipment!*

SG TOW 3/71

Australian National Distributors:

Simon Gray Pty. Ltd.

Head Office: 28 Elizabeth St., Melbourne, Vic. Tel. 63 8101*, Telex 31904; **Sydney Office:** 53 Victoria Ave., Chatswood, N.S.W. Tel. 40 4522*; **Canberra Office:** 25 Molonglo Mall, Fyshwick, A.C.T. Tel. 95 6526; **Adelaide Office:** 301 South Terrace, Adelaide, S.A. 5000. Tel. 23 6219. **INTERSTATE REPRESENTATIVES: N.T.:** Pfitzner's Music House, Smith St., Darwin. Tel. 3801; **Q'land:** Sydney G. Hughes, 154-158 Arthur St., New Farm, Brisbane. Tel. 58 1422; **Tas.:** K. W. McCulloch Pty. Ltd., 57 George St., Launceston. Tel. 2 5322; **W.A.:** Athol M. Hill Pty. Ltd., 613-615 Wellington St., Perth. Tel. 21 7861.

**Simon Gray Pty. Ltd.,
28 Elizabeth Street,
Melbourne 3000.**

Please send me all the facts about: (a) Thorens turntables; (b) Ortofon cartridges; (c) Watts record cleaning equipment . . . and the name of my nearest franchised Simon Gray dealer.

NAME ....

ADDRESS ....

.... POSTCODE ....

along the lines of the Elgar piece though without that composer's vigorous invention. It does, however in its modest way, caputre the spirit of the old grey city, the background of a people who, when they indulge in pageantry, are without peers.

The Epic March has all you'd expect in a piece commissioned for patriotic purposes during the last war. Its best feature is a nice "open air" second subject in E Flat.

In The Holy Boy for string orchestra Ireland is occasionally reminiscent of his Sea Fever. It is a Christmas carol of the Nativity and has been popular in England since its composition for piano solo in 1913. The string version was arranged by the composer in 1941.

The Concertino Pastorale for Strings is in three movments. The first, an Eclogue, reflects the tension of 1939 pre-war England, beginning with a tense introduction then passing into a rather non-committal statement of pastoral ruminations that fragment at the end.

The second disc opens with the Prelude, The Forgotten Rite, inspired by the evidence of the prehistoric past still to be found in the Channel Islands. Mai-Dun was also inspired by prehistoric ruins, this time Maiden Castle near Dorchester. It aims to evoke early struggles of this fortress to repel invaders back in the days of Roman Britain and displays considerable orchestral and harmonic resources.

Legend for Piano and Orchestra again goes back to prehistoric Britain for inspiration, a mediaeval leper colony, and a curious vision that Ireland had of ghostly children dancing, all set out with great skill and refinement. The sensitively played piano part is by Eric Parkin.

The overture Satyricon is based on the famous novel by the ancient Roman Petronius. It has a lovely clarinet solo in the middle section but elsewhere shows only little of the rumbustious spirit of the elegant Roman's naughty literary achievement. The London Philharmonic under Sir Adrian Boult plays the whole program affectionately and the sound on both discs is better than fair.

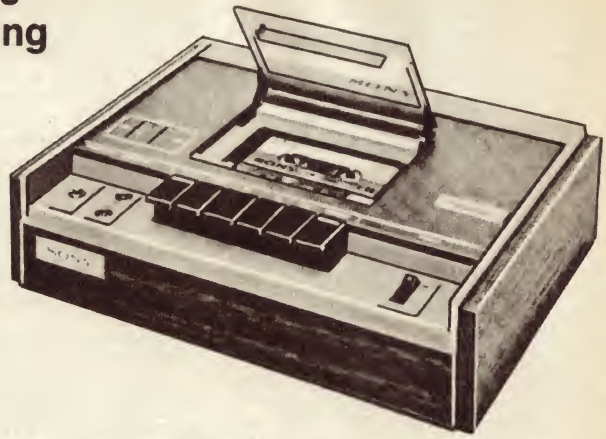
★ ★ ★

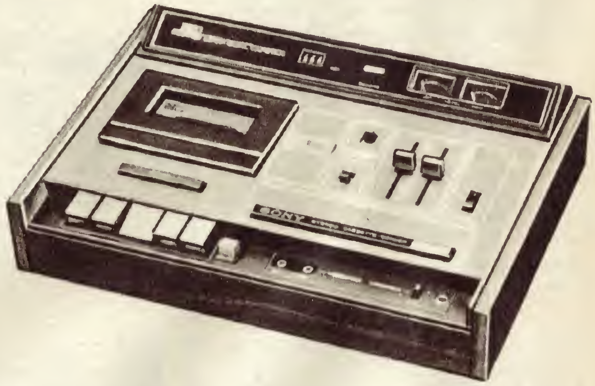
DONIZETTI — Roberto Devereux. Complete Opera. Beverly Sills (Queen Elizabeth); Peter Glossop (Nottingham); Beverly Wolff (Sara); Robert Ilosfalvy (Devereux) and others with the Royal Philharmonic Orchestra and the Ambrosian Opera Chorus conducted by Charles Mackerras. World Record Club Stereo S / 4935 / 7. Three Discs.

After nearly a century of neglect this opera is again appearing in the repertoires of important opera houses. Those acquainted with the strange story of the aging queen and her young subject, especially as told by Lytton Strachey, will disapprove heartily of the distortion introduced by Donizetti's librettist, Cammarano, even when the demands of operatic licence are considered. But this does not impair some very fine moments brought off with superb skill by the composer, though it must be admitted that there are, too, some that are very trumpery indeed. I did find, however, the the opera grows on one with repetition and that many of the set's weaknesses can be laid squarely at the door of Beverley Sills in the title role.

Only very rarely indeed does she project either vocally or dramatically the formidable nature of the queen she is playing. Her voice lacks colour and dramatic intensity and to compensate for the absence of the latter she over-indulges in such substitutes as "dramatic" parlandos — a sudden descent from song to speech quite alien to Donizetti's style. I find it difficult to understand just how a conductor with Mackerras' respect for integrity could have approved such lapses. And I find it still more surprising that a musician with such an interest in authenticity could have stated that later changes to the original orchestration "must be minimal."

However having got my most serious disappointments off my chest I must reiterate my enjoyment of an opera that was well worth reviving. As soon as one has surmounted the handicap of Miss Sills' lack of indentification with her role and her trivialisation of much of Donizetti's ornamentation, which is nearly always far removed from the trivial and often very subtle, you will find much to enjoy in the score. Both Ilosfalvy (Essex) and Glossop (Nottingham) are always commendable if seldom exciting. On the other hand Beverly Wolff (Sara) though occasionally a trifle insecure produces a mezzo-soprano voice of a quality that promises great things for her future recordings, Mackerras is, as always, impressive in his conducting. The orchestra's attack is crisp, its rhythms vital and the nuancing sensitive. Indeed it is he who makes the most valuable contribution to the whole production.





VARIETY FARE

REVIEWS OF OTHER RECORDINGS

Devotional Records

THE BEST OF FRANK BOGGS. Stereo, Word WST-8548-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.)

Frank Boggs, one of the best-known artists on the USA "Word" label, has a magnificent bass-baritone voice, strongly masculine yet as smooth and true as they come. Most of the numbers on the album have a full but restrained orchestral backing but, for a variety, a couple are backed only by his own solo piano.

The tracks: Come Thou Fount — Does Jesus Care? — Yes, God Is Real — The Old Rugged Cross — Fill My Cup, Lord — The Saviour Is Waiting — His Eye Is On The Sparrow — Sweet Little Jesus Boy — Every Time I Feel The Spirit — What A Friend We Have In Jesus — Amazing Grace — I Never Walk Alone.

The album is titled "The Best of Frank Boggs" and there's not the slightest reason to question it. Very well recorded, it's the most enjoyable Gospel vocal album that I've heard in many a long day. Strongly recommended. (W.N.W.)

★ ★ ★

MARTHA. Martha Nixon with orchestra and chorus directed by George Coward. Stereo, Unison BRC-017. (From A.A.V.R., 87a Mullens St, Balmain 2041.)

I well remember the occasion when Martha Chastain (I'm not sure of the spelling) arrived in Australia, the youthful protege of the evangelistic team of Neil and Pat Macaulay. Now very much a part of the local scene, the wife of evangelist Les Nixon, Martha is well known to Australian audiences from her television appearances.

Reviewing this, her latest album, Sydney broadcaster Ross Saunders suggests that Martha sounds a little hurried, a little tired and, along with some of the arrangements, a trifle old-fashioned.

Judged by the pop scene standards there may be some justification for these remarks but are these the right criteria? If I'm any judge, Martha Nixon and arranger George Coward have ended up with a sound which will have wide appeal, modern enough to retain the interest of a fair slice of the 'teen audience, yet smooth enough and round enough to be accepted by the older generation as well.

The titles: Come Alive — What Grace Is This — The Lord Is My Shepherd — I Looked For Love — We Never Wonder Who — He Never Changes — All My Life — He'll Be A Friend To Me — Who Can We Turn To? — He Touched Me — When You're Young.

The quality is okay technically and I think that most Gospel orientated listeners will like the new album. Good family listening. (W.N.W.)

★ ★ ★

SONGS FOR SUNDAY. Jimmy Durante, with orchestra and chorus conducted by Ralph Carmichael. Stereo, Light, LS-5565-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.)

There has only ever been the one, unmistakeable Jimmy Durante. Who hasn't seen him in films, heard him on air, watched him on television? Well here he is on record, singing hymns, and in his own inimitable style. He's no songbird? Perhaps he's not, but he knows his music and I doubt that he's ever had better backing than is provided here by Ralph Carmichael.

The ten tracks: Down By The Riverside — Precious Lord — He Touched Me — In The Garden — Somebody's Keeping Score — Amen — Beyond The Sunset — Peace In The Valley — His Eye Is On The Sparrow — One Of These Days.

Whether or not you'll enjoy this record is very much an individual matter; it's bright in parts, meditative in others but always sincere. Listen to "He Touched Me" and "Amen", then make up your own mind. (W.N.W.)

★ ★ ★

THE COMPREHENSIVE FOLK. Stereo. Parker Records PR-002. (From Parker Recordings, 9 Carmel Place, Winston Hills, NSW 2153. Price $4.50 plus 50c package and postage.)

The Comprehensive Folk — Bronwyn Field, Ross Davey and David Carr — were formed as a group in 1968 from the methodist church at East Denistone, Sydney. Using 6- and 12-string guitars, double bass and a tambourine, their repertoire includes quite a few of their own compositions.

Since 1968 they have featured in Gospel coffee shops all over Sydney, on Channel 9 TV "New Faces Auditions", on 2CH "Gospel Sound Spectacular" and in the NSW "Newness Mission". Circumstances forced the dispersion of the group just after this recording was made early this year.

There are 12 tracks on the two sides: A Meeting Here Tonight — Gonna Show I'm Happy — When The Stars Begin To Fall — Tell The Whole World Our Song — I Think, I Feel — All My Trials — Sing A Happy Song — Questions And An Answer — When I Survey — Let Us Break Bread Together — That Extra Mile — This Little Light Of Mine.

The Comprehensive Folk have the happy kind of sound that has won them acceptance in the circles in which they have moved and this limited issue album, in its plain white jacket, will provide a link to those who have enjoyed their appearances. However, their performance lacks the variety and the ultimate polish necessary for a successful LP and I doubt that this one will have too much appeal outside the coffee shop audience. (W.N.W.)

★ ★ ★

HE SEES. The David McIlraith Singers. Stereo, RCA Victor SL-101947.

An unusual record, this. From the notes, it would appear to have coalesced around teenage soprano, Elizabeth Ryan, who entered show business through a successful appearance in television's "New Faces". Around her, entrepreneur David McIlwraith formed his singers and, for the music, chose several themes from Robert King Crawford's as yet unpublished musical drama based on the life of the Virgin Mary. To these themes Crawford added lyrics and arrangements based on melodies from the classics.

It is these latter which really dominate the album and, ironically, it is the male voices which are most notable both for their quality and their diction.

Here are the track titles with their basis, where applicable: The New Lord's Prayer (Crawford) — He Sees (Smetana) — Wondrous Road (Greensleeves) — Who? (Crawford) — Love is The Song (Tchaikovsky, Symphony 5) — At the Close Of The Day (Brahm's Lullaby) — Hail Mary (Crawford) — Summer Air (Chopin) — Hymn To Relativity (Tchaikovsky, Swan Lake) — The Veil (Borodin, Polvtsian Dances) — How Many Wonders (Tchaikovsky, Pathetique) — The New Wedding Song (Tchaikovsky, Piano Concerto 1).

If words to the classics affronts, you won't want the album. If the idea appeals, you'll like it. Ron Wills, A&R Manager for Australia, is banking on a good reception for the disc. He bought world rights for RCA when he heard the tapes of the recording session in the GTV-9 television studios, Melbourne. Technically, the quality is good. (W.N.W.)

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.) and Gil Wahlquist (G.W.).

Instrumental, Vocal and Humour . . .

DIE KLUGE (The Wise Woman) — Carl Orff. Lucia Popp, soprano; Kurt Bohm, bass; various artists; Bavarian Radio Orchestra conducted by Kurt Eichorn. Produced by Carl Orff. World Record Club stereo S-5066-7. Two disc boxed set with German-English libretto.

This musical folk tale for stage performance, based on a story by Grimm, is very much like the other Carl Orff work "Der Mond" (The Moon) which World Record Club issued a few years ago. Presumably those who know "The Moon" will want this work also. To my mind, "The Moon" is a more interesting work, superior musically and easier to follow by those with little or no knowledge of German. "The Wise Woman" has a considerable amount of spoken dialogue, taking up about half of the total playing time. Even with WRC's excellent two-language libretto, I imagine those not conversant with the German language will find themselves in difficulties trying to follow the action.

The accomplished Lucia Popp sings the part of the Wise Woman. The tale tells how she outwits the despotic feudal king, who executes or imprisons his subjects at the slightest provocation, real or imaginary. The smallness of the part and simplicity of the vocal writing does not really require an artist of Miss Popp's stature, but I suppose we should not complain on that score. The robust bass voice of Gottlob Frick is admirably suited to the role of the peasant father of the wise woman, lamenting and languishing in jail. Thomas Stewart, baritone, sings competently as the King, and the minor roles of the three Vagabonds are very well presented by Ferry Gruber, tenor, Neinz Friedrich, baritone, and Kurt Boehme, bass.They certainly sound sly, shifty, bawdy or plain dishonest, as required. The orchestra provides excellent support to the vocalists, and the whole performance was produced by Carl Orff in person.

This is a new recording, dating from 1970, and the sound is excellent, with no noticeable distortion and good stereo spread. (H.A.T.)

★ ★ ★

DON GIOVANNI — HIGHLIGHTS (Mozart). Joan Sutherland, Pilar Lorengar, Marilyn Horne, Gabriel Bacquier and others, with the English Chamber Orchestra, conducted by Richard Bonynge. Decca (EMI) stereo SET 496.

I have kept this recording for some time before reviewing it, to see if the generally unfavourable impression I gained of it at first hearing would modify. Unfortunately, this is not the case, and I cannot but feel that the set from which this selection has been taken is a far from satisfactory account of "Don Giovanni". The singing is competent, as one would expect of the strong cast, but no more. By the way, since there is no cast list on the sleeve, I will indicate who sings what role here: Joan Sutherland is Donna Anna; Marilyn Horne is Zerlina; Pilar Lorengar is Donna Elvira; Gabriel Bacquier is Giovanni; Donald Gramm is Leporello; Werner Krenn is Ottavio; Clifford Grant is the Commendatore; Leonardo Monreale is Masetto.

In the female roles, Pilar Lorengar provides the only satisfying performance. Not only is her voice beautifully controlled, but her characterisation of the role of the near hysterical Elvira is quite convincing. On the other hand, Marilyn Horne is far from convincing as Zerlina — her strong voice inclines one to believe that she is quite capable of handling the hanky panky of the Don. Joan Sutherland is below her best — her singing lacks sparkle, and her diction is even worse than usual. On the credit side, Bacquier makes a splendid Giovanni, suitably seductive or menacing, as the occasion demands. None of the other parts is particularly outstanding, although in the scene where the Don is dragged down to Hell, the Commendatore of Clifford Grant commands the attention. The English Chamber Orchestra under Richard Bonynge provide an elegant accompaniment, but it is too lightweight for my taste. The recording quality is fine. (H.A.T.)

★ ★ ★

BACH FESTIVAL OF HITS. Various artists. DGG (Phonogram Recordings) stereo 2538 118.

DGG has entered the "Classics for Youth" field with a series entitled "Festival of Hits", containing the same kind of material as the "Greatest Hits" discs of CBS and RCA. The first to come my way is this disc of the music of Bach — and what a splendid disc it is! The selection is a very enjoyable one, which should have wide appeal, and the Munich Bach Orchestra and Chorus who perform in most of the tracks provide the kind of performance one expects of a group of their experience — absolutely first rate. They are conducted in all tracks by the Bach specialist Karl Richter, who also contributes a magnificent organ solo of the Toccata anf Fugue in D minor — a black mark, incidentally, for the DGG company for not identifying the organ, which is a superb instrument.

Richter's group perform the following: Opening Chorus and Shepherd's Pastorale from Christmas Oratorio — Badinerie from Orchestral Suite No 2 — First Movement from Double Concerto for violin and oboe — First movement from Brandenburg Concerto No 4 — Jesu, Joy of Man's Desiring — Air and Gigue from Suite No 3 in D. The second movement of the Harpsichord Concerto No 5 is played by Ralph Kirkpatrick and the Lucerne Festival Strings. Sviatislav Richter presents a beautifully controlled account on piano of the First Prelude from "The Well Tempered Clavier". The tracks are all from current DGG recordings, and I have no hesitation in rating the sound A1. For the benefit of those who might want to obtain the full recordings, catalogue numbers are given against all items. (H.A.T.)

★ ★ ★

STRAUSS FESTIVAL OF HITS. The Berlin Philharmonic Orchestra conducted by Herbert von Karajan. DGG (Phonogram Recordings) stereo 2538 147.

There is surely no need to dwell long on this recording. Such an eminent conbination as the Berlin Philharmonic and von Karajan can be relied upon to present a performance well above average — which they do. Just

look at the titles, and if these appeal, buy with confidence: Blue Danube Waltz — Radetsky March — Annen Polka — Delirium Waltz — Vienna Blood Waltz — Pizzicato Polka — Emperor Waltz — Hunting Polka. Those who know their Strauss family will realise that all items are not from the pen of the younger Johann Strauss — his father Johann senior, and his brother Josef, are also represented. Nevertheless, all fine music, splendidly played and beautifully recorded. The recording is notable for the wide dynamic range, and is otherwise of the usual DGG excellence. (H.A.T.)

★ ★ ★

J. S. BACH TRANSCRIPTION FOR ORCHESTRA. The Pro Arte Orchestra of Munich conducted by Kurt Redel, with Helmut Rose, harpsichord. World Record Club stereo S / 5089.

Arguments have always raged about the musical validity of transcriptions, particularly when the works involved are by composers of the stature of Bach. The ante-transcription faction is not likely to be converted by anything I may say here, but if you are not biassed, this disc is well worth a trial. The pieces have been arranged with a great deal of skill and understanding by Kurt Redel, and are given polished performances by the Munich Pro Arte. The major work is the great Passacaglia and Fugue in C minor, a masterpiece of imposing dimensions, which sounds quite marvellous in this arrangement. The old orchestral warhorse, Toccata and Fugue in D minor is also included, and I was surprised to find how much pleasure I derived from listening to it — it is a long time since an orchestral transcription of this has held my attention.

The remaining items are: Aria, "Wie Furtsam", BVW 33 — Chorale, "Mache Dich Dein Geist Bereit", BVW 115 — Allegro Molto, Chorale in B minor, BVW 36 — Chorale Prelude in B minor, BVW 727 — Eine Feste Burg, Aria in D major, BVW 80. The recording, originally by Erato, Paris, is of excellent quality, the string tone being exceptionally good. (H.A.T.)

★ ★ ★

THE GUITARS OF SERGIO AND EDUARD ABREU. Decca Ace of Diamonds (EMI) stereo SDDA 219.

The two young Brazilian brothers featured here will be visiting Australia soon, which is why this disc has been re-issued on the budget price Ace of Diamonds label. When the disc was first released in 1969, they were only 21 and 20 years old respectively, yet they demonstrate a mastery of their instruments and a degree of maturity and sensitivity in their playing which is little short of astonishing. Their duet playing is particularly impressive, demonstrating immaculate timing and complete understanding between the pair. There are five duets and seven solos in the recital.

The program is an interesting one, with the whole of the first side taken up by works of the 16th and 17th centuries, while side two has all 20th century music. Side 1: Sir John Langton's Pavan (Downland) — Fugue (Frescobaldi) — Preludio and Corrente (Vivaldi) — Sonata in D, L.104 (Scarlatti) — Lute Suite No 3, S.995 (Bach). Side 2: Preludio No 1 and Estudio No 1 (Villa Lobos) — Estudio sin Luz (Segovia) —

Madronos (Torroba) — Divertimento (Segovia) — Pavane our une Infante Defunte (Ravel) — El Puerto from "Iberia" (Albeniz). For those with a liking for classical guitar recitals, recommended. The recorded sound is very realistic. (H.A.T.)

★ ★ ★

OVERTURE SPECTACULAR. The Royal Liverpool Philharmonic Orchestra conducted by Charles Groves. Columbia stereo SOEX 9678.

Anyone beginning a collection of classical music should have at least one record of popular overtures. The brilliant overtures featured on this disc certainly make a good start. They are played by a very professional orchestra — the Royal Liverpool Philharmonic conducted by Charles Groves. The sound quality is uniformly good and the stereo spread is wide. At the economy price of the Columbia Series 275, the disc is a bargain.

Six overtures are presented: Light Cavalry by Von Suppe; Nabucco by Verdi; Zampa by Herold; Ruy Blas by Mendelsohn; Mignon by Thomas; Donna Diana by Reznicek. (L.D.S.)

★ ★ ★

GIPSY FLAMENCO. Carlos Montoya, guitar, with supporting artists. Probe (EMI) stereo SPSS 8988.

Any disc by the brilliant flamenco guitarist Carlos Montoya is always welcome, but doubly so when it offers 16 tracks for a mere $2.75. Most of the tracks are the familiar guitar solos with which Montoya has entertained the world for many years — with titles such as Bulerias, Jota, Guajiras, Alegrias and Fandango — but some variety is given to this program by supporting artists. For those familiar with flamenco terms, these contributions are cantor, taconeo and zapateado, in jaleo style — in other words, there is plenty of vocalising, hand clapping, and foot stamping. Montoya is, as usual, magnificent, and the range of sounds he can produce with his instrument always amazes me. Sound and stereo spread are both of good standard. At the low price, the disc carries a strong recommendation. (H.A.T.)

★ ★ ★

THE MAGIC OF PIGALLE. Various artists. His Master's Voice "World Wide" series (EMI) stereo SOELP 9784.

At $2.75, this latest release in the "World Wide" series will be keenly sought by those with a liking for the French chanson, as exemplified by the many fine artists presenting this kind of material in the 1940s and 1950s. If you have any knowledge of the subject at all, you will need no more than a list of the titles and names to realise the value of this collection: Pigalle (George Ulmer) — Clopin Clopant (Pierre Dudan) — La Fourni (Juliette Greco) — Et Je T'Aime (Les Peters Sisters) — Je-Te-Le-Le (Maria Candido) — Le Petit Cordonnier (Yvette Giraud) — La Rue S'Allume (Michele Arnaud) — Me-Que, Me-Que (Gilbert Becaud) — Mon Pot' le Gitan (Jacques Verrieres — Sous le Ciel de Paris (Edith Piaf) — Mes Jeunes Annees (Charles Trenet) — J'Attendrai (Tino Rossi) — Tout Ca Parc'qu'au Bois D'Chaville (Jacques Pills) —l'Amour, Madame (Claude Robin) — Une Boucle

Blonde (Georges Guetary) — Sur Ma Vie (Charles Aznavour).

This is a really splendid selection, executed with all the elegance of style and sophistication one associates with French artists of the stature of those presented here. Many of the recordings have been remastered from 78rpm originals, but this has been done expertly, so that although there is rather more background noise than with modern recordings, the sound is generally very good, allowing excellent comprehension of the lyrics — of course, this is helped by the diction of the artists, which is extremely clear. Some of the tracks plainly originate from LP masters, and you will have no difficulty identifying these. Naturally, the stereo is simulated, but it is quite unimportant in discs of this kind, where the spotlight is on a single performer. (H.A.T.)

★ ★ ★

MANCINI CONCERT. Henry Mancini and his concert orchestra. RCA Victor stereo LSP-4542.

The cover notes of this album state that no other previous album has demonstrated the remarkable versatility so positively as this one. I would not agree. It is remarkable that a composer of popular film themes could produce such a dull and uninspiring performance.

There are four medleys, entitled: Portrait of Simon and Garfunkel — March with Mancini — Jesus Christ, Superstar — Big Band Montage. The Overture from "Tommy" completes the disc. The overture is passable and the "big band montage" gives an authentic recreation of the bands of the 40s and 50s. Apart from this, there is little to commend it musically. Sound quality is good. (L.D.S.)

★ ★ ★

GREAT MOTION PICTURE THEMES. Various conductors and orchestras. His Master's Voice stereo SOXLP 7541.

EMI certainly have best-seller material on their hands with this disc. All the themes are extracted from the classics and they are played by top-flight orchestras and conductors. Side one begins with the opening theme from the film "2001 — A Space Odyssey" and it is hard to think of a more impressive short piece of music than the beginning of the Strauss tone poem, "Also Sprach Zarathustra". This is played by the Philharmonia Orchestra conducted by Lorin Maazel.

Following the above piece is the theme from "Death in Venice" which is from Mahler's 5th Symphony, played here by the New Philharmonia Orchestra under Sir John Barbirolli. Completing side one is the theme from "The Mephisto Waltz" which appropriately enough, is Liszt's Mephisto Waltz No. 1, played as a piano solo by John Browning.

Side 2 begins with the theme from "Elvira Madigan", which is the slow movement from Mozart's Piano Concerto No 21 in C, played here by Daniel Barenboim on piano, while also conducting the English Chamber Orchestra. This music admirably reflects the nostalgic beauty of the film, and many people will buy the disc for this piece alone.

Centre piece on Side 2 is the theme from "The Music Lovers" and regardless of how one might have been affected by the film, the Finale of Tchaikovsky's "Pathetique" Symphony merits its place on this disc as a beautiful piece of music. It is played by the Philharmonia Orchestra conducted by Carlo Maria Giulini. Completing the list is the theme from "Five Easy Pieces" which is Chopin's Prelude in E minor, Op. 28 No 4. played by Leonard Pennario.

The recording quality on the disc is variable as it has been taken from a number of masters but in most tracks it is good (L.D.S.)

★ ★ ★

GALA RUSSE. The Don Cossack Choir, conducted by Serge Jaroff. MCA (Astor) stereo MAC / S 2169.

With some 50 years of active performing behind them, during most of which they have been recording, the Don Cossack Choir has probably long since exhausted the available Russian songs which is their exclusive material. Intending purchasers will therefore closely scrutinise the titles before investing in this latest relaese, particularly if they have been buying the Choir's discs for some years: Back From the March — Cossacks in Captivity — From the Forest — Across the Ural River — Kuban Regimental Song — The Glory of the Cossacks — In 1893 (Don Cossack Song) — Student Songs (Medley) — Cherubim Hymn — The Legend of the Potchaev Monastery — Katiusha. If you can find sufficient unfamiliar material here to justify your purchase of the disc, you are not likely to find anything to complain about in either the performance or the recording, which is very good. The disciplined singing of the choir is just what we have come to expect from this group of specialists, and the sound is clean with good dynamic range and stereo spread. (H.A.T.)

★ ★ ★

GET HAPPY. Lyn Larsen at the Senate Theatre Organ, Detroit. Stereo, Concept CRS-3102. (From 6 Carrington St, North Balwyn, 3104. Also from Winton Music Centre, 44 Edward St, Summer Hill, 2130.)

A letter to hand from Australian organist Tony Fenelon advises that this recording was made by the engineer of the Detroit Theatre Organ Club, involving what he considers to be one of the finest Wurlitzers in the USA — an instrument boasting 4 manuals and 34 ranks. For those interested in technical detail, the specifications are listed on the jacket.

After his recitals in this country and his earlier releases, the young American organist Lyn Larsen will need no introduction to Australian popular organ enthusiasts. He is in fine form as he plays some "Get Happy" themes, interspersed with items in more serious vein: Get Happy — Soon It's Gonna Rain — 42nd Street Overture — Only A Rose — March of the Siamese Children — The Last Spring (Grieg) — Married I Can Always Get — Lullaby (Rosemary's Baby) — Fantasie Impromptu. (Chopin).

If you want to sample his sheer skill at the console listen to that last track. And, incidentally, it's a fine an example of popular organ recording as you're likely to hear anywhere — clean, well balanced and well

spread between the stereo channels. A "must" for organ enthusiasts. The price, by the way, is $5.95, plus 35c postage and package, plus exchange. (W.N.W.)

★ ★ ★

CASCADE. Manuel and the Music of the Mountains. Columbia stereo SOEX 9782.

Buyers of previous "Music of the Mountains" discs need have no hesitation in buying this budget priced re-issue, which has been popular since its first release some years ago. Manuel (or Geoff Love, to give him his real name) uses a large orchestra with emphasis on "singing strings". The recording quality is not entirely faultless, and there is an edginess on the string tone, but this is quite mild, and can be overlooked — particularly as the disc costs only $2.75. Stereo spread is good.

Thirteen tracks are featured: A Banda — Theme From "Love Story" — A Song of Joy — Say Hello To Yesterday — Cascade — Stranger On the Shore — Dancing In The Sun — Eso Beso — Indian Summer — Proud Matador — Nobody Knows — Spider Of The Night — La Bamba. (L.D.S.)

★ ★ ★

THE SPANISH SCENE. Various artists. His Master's Voice "World Wide" series (EMI) stereo SOELP 9808.

I was interested to see that EMI are now issuing the "World Wide" series in the budget price $2.75 range, instead of the $5.75 range as previously. At this price, the series becomes a very attractive proposition, as the standard of performance and recording has been consistently high. This second disc to feature the music of Spain is no exception. It takes in a rather wider range than the first disc, as it includes not only night club music, but flamenco and light music also. This still leaves serious gaps (why no zarzuela and bullring music, for example), but within its limitations it provides enjoyable listening. Well known numbers included are: Cuando Sale de Cuba — La Banda — Cu-Cu-Rru- Cu Paloma — Spanish Eyes. The remaining 10 titles are unlikely to be widely known. (H.A.T.)

★ ★ ★

THE SOUL OF SPAIN — Vol. 3. 101 Strings. Astor Stereo 4 compatible four-channel recording QS 1.

Vols 1 and 2 with the same title as this disc have been extremely popular for a long time — probably more than 10 years in the case of Vol. 1. Vol. 3 is very much like the others — orchestra with large string section playing arrangements of popular Spanish tunes, some up tempo and with rhythm backing. The titles in this case are: Ritual Fire Dance — Andalucia (Granados) — Selection from "La Boda de Luis Alonso" — Novillero — Ante el Escorial — Las Gaditanas — Fiesta Flamenco — Cordoba (Albeniz). All very-tuneful, very Spanish and very enjoyable.

The disc was played on a normal stereo system, but the observant reader will have noted above the reference to four-channel sound. This disc is in fact one of the first four to be issued by Astor for use with the Electro-Voice four-channel sound system. Although the hardware is very scarce at the moment, this is not important, since the discs are fully compatible with normal stereo equipment. If four-channel becomes the established thing in the future, owners of these discs will have a head start with their collections. On the other hand, if four-channel does not get off the ground, you haven't lost anything — particularly as these discs are being issued right from the start at the low price of $3.99 each. The sound is quite good, with just a slight edge of distortion on peaks. There is no room for a more detailed discussion here, but see the article on four-channel sound elsewhere in this issue. (H.A.T.)

★ ★ ★

TODAY'S HITS. 101 Strings. Stereo-4 compatible four-channel, Audio Spectrum QS-4.

Here's another of the four-channel discs just released in Australia, using the Electro-Voice matrix system, of the general type discussed elsewhere in this issue.

I played it, as most will for the time being, on a normal two-channel stereo system, listening for any hint of abnormality. It's a very "busy" recording with a lot of musicians seemingly crowded on to the front sound stage — possibly the result of not using four channels. Otherwise the spread is normal enough, though with no sense of extending beyond the loudspeakers. In terms of general quality, the balance is normal and the sound well up to normal standards.

Under the baton of Jack Dorsey, the selections should please: Theme From "Love Story" — El Condor Pasa — Raindrops Keep Falling On My Head — Eidelweiss — Oh Happy Day — Mozart Symphony 40 In G-Minor — Close To You — Bridge Over Troubled Water — I'll Never Fall In Love Again — Everybody's Talking.

At $3.99 the disc is good value for normal stereo reproduction. If you happen to equip later with four channel, you'll be that much ahead. (W.N.W.)

★ ★ ★

LAST OF OLD ENGLAND. James Last, with orchestra and chorus. Polydor stereo 2371, 164.

With his usual flair for the original, James Last has collected here a bunch of traditional English airs and ballads, and arranged them as medleys in dance tempos. The usual skilful Last arrangements and polished playing of the band are supplemented on this occasion by a female choir. Presumably because their knowledge of the English language is not too good, the choir are not called upon to sing the words of the songs, and they just hum and "ah" their way through the melodies. It's all very entertaining, and should be fine for dancing too. The titles, all very well known, include such popular tunes as Sweet Lass of Richmond Hill — Rule Britannia — Begone Dull Care — The Vicar of Bray — Polly Oliver — Cherry Ripe. It is probably superfluous to say that the quality of the Polydor recording is first class. (H.A.T.)

★ ★ ★

THE SEEKERS / Vol 2. World Record Club stereo S / 4727.

There are two reasons for people buying this disc: the still considerable popularity of the now-defunct group and the recent tour of Judith Durham who was the driving force (vocal) behind the group. Whatever the reason, the disc is a good one at the WRC price of $3.39. Recording quality and stereo spread are good throughout.

The 12 tunes featured are: The Last Thing On My Mind — Well, Well, Well — Four Strong Winds — Love Is Kind, Love Is Wine

— Just A Closer Walk With Thee — 59th Street Bridge Song (Feelin' Groovy) — On The Other Side — This Land Is Your Land — Days Of My Life — Can't Make Up My Mind — Study War No More — Emerald City. (L.D.S.)

★ ★ ★

THE FIRST MEN ON THE GOON. The Goon Show. Parlophone (EMI) mono PMCO 7132.

The reason for the title of this disc is not at all clear, as those taking part are not all regular Goon Show participants, and Michael Bentine, who was one of the originals, is not in the two shows presented. However, Goon Show addicts, of which there are still a great number, will welcome the chance of adding these to their collection. Side 1 has "Foiled by President Fred", concerning some improbable happenings in a South American Republic, where Neddy Seagoon goes to collect a gas bill for four shillings and ninepence, required to keep the South Balham Gasworks solvent; and Side 2 is a Goon Show Christmas special, "Robin Hood and His Merry Men", where the regulars are joined by Valentine Dyall (Sheriff of Nottingham) and Denis Price (Prince John).

The inspired idiocy is right up to normal Goon Show standards, and is sure to keep those inflicted with Goon-itis happy for weeks ahead. The mono only sound is adequate, although as usual much of the ad libbing is lost in background noises and audience noise. (H.A.T.)

Jazz and Rock . . . .

BOB DYLAN'S GREATEST HITS Volume 2. CBS stereo (S2BP 220085).

Of 22 songs spread over two LPs there are only five songs which Dylan hasn't sung before. Of course there are plenty of people who don't own everything. The album appears to have been inspired by the bootleg records of "basement" performances by Dylan. These records appeared in great numbers in the past two years.

Some of the performances, rushed and not really typical, legitimatize the undercover performances which we have heard. There's "Watching the River Flow" recorded with Leon Russell and "When I Paint My Masterpiece" which The Band recorded on their last disc.

One of the surprises is "Tomorrow's Such a Long Time" recorded at a 1963 Carnegie Hall concert. Back in those far off days the music had a direct quality and a command of the situation which Dylan doesn't seem to have today. A Dylan performance these days involves a number of other musicians and to some extent a dissipation of those earlier forces.

The sound quality over the album varies with the venue. (G.W.)

★ ★ ★

THE CONCERT FOR BANGLA DESH. Apple stereo (STCX 3385).

Bob Dylan was the central performer in this outstanding concert organised last year by George Harrison to aid children in the Pakistan conflict. The usual concert recording is something which the record buyer has learned to live with. Poor balance and poor sound quality are endured for the sake of an exciting performance. Luckily, Harrison is a perfectionist who has insisted on good quality right through. Not only are the performances good, but the sound is there to match.

There are three LPs with performances selected from two concerts, boxed with a large colour book. The price ($17) compares favourably with what you would pay for three separate LPs and no book.

From a musical point of view the concert was the first jam between Dylan and the Beatles. Dylan, Leon Russell, Ringo Starr and George Harrison formed an exciting quartet which performed "Hard Rain", "Blowin' in the Wind", "Mr Tambourine Man" and other Dylan numbers.

Dylan's voice isn't as raspy as it used to be. Billy Preston and members of Badfinger were along. Ravi Shankar plays for one side with top sarod player Ali Akbar Khan.

The whole set is undeniably the best concert recording to come from a rock or folk festival. (G.W.)

★ ★ ★

SHANANA. Kama Sutra stereo 2319 007.

The revival of early sixties rock and roll got under way when this group appeared at the Woodstock rock festival a couple of years ago. Groups in Australia like "Daddy Cool" followed the Shanana example.

The music has great verve, is rhythmical and bombards the ears with two-beat music. "Yakety Yak", "Jailhouse Rock" and "Great Balls of Fire" feature on the first side, recorded at a live concert.

Shanana show great spirit on this side. Unfortunately on the second side, a studio performance, they try to take on a ballad style and become just another band with not much to say.

★ ★ ★

WEIRD SCENES INSIDE THE GOLD MINE. The Doors. Elektra stereo (8E-6001).

Jim Morrison was one of the few poets of pop to ever get anywhere in the rock scene. He had been popular for five years before his death last year, a strange, tortured figure whose intense songs seemed unsuited to the pop scene yet made it anyway.

This was the beginning of dark music, songs preoccupied with misery and darkness.

The little darlings of pop had their Greek tragedy after all in the music of Jim Morrison, his organ player Ray Manzarek and guitarist Robbie Kreiger.

These two LPs go back to the first single, "Break on Through", and include two of the big performances by The Doors, "The End" and "The Music's Over". Recording quality is good. (G.W.)

★ ★ ★

TUPELO HONEY. Van Morrison. Warner Brothers stereo 1950.

Van Morrison is the most impressive of the current composer-performers. He writes his own material, plays acoustic guitar, and sings very well indeed. The title song is superbly sung by Morrison who shows a sense of structure, building a performance around a tuneful theme and a simple, uncomplicated lyric.

"Start a New Life", "You're My Woman" and "Old Old Woodstock" are a bridge between country music and rock and roll. The recording quality and stereo is first class. (G.W.)

40% OFF THIS FAMOUS NAME COMPLETE HI-FI SYSTEM!

JUST $199

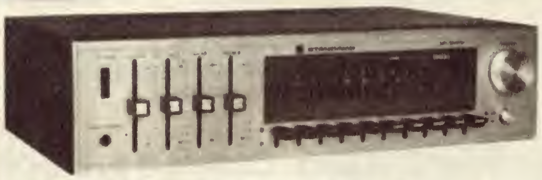
We've 25 of these quality sets going right now at cost. Think we're kidding? We almost wish we were. Take a look at what you're getting—$330 **wholesale** value for $199.

GARRARD MODEL 40B PLAYER
With magnetic cartridge, manual/automatic operation, automatic switch-off. Not to mention the Garrard reputation.

STANDARD HI-FI AMPLIFIER PM 157E
Solid-state, 18-transistor stereo unit with low distortion ratio, wide-power band width and personal headphone jack for listening alone. Input circuit incorporates tuner, phono, tape, aux for widest range of applications.

STANDARD LOUDSPEAKER SYSTEM MODEL 210K
Compact set prestige-finished in oiled walnut. Two-way system combining 8" Woofer for low sounds, high efficiency 4" tweeter for high sounds.
Teak finish cabinet for record player $19, if required.

SR STANDARD



SAVE $168 ON SR-606SE STEREO TUNER/AMP

$199 (LIST: $367)

A tremendous buy for the enthusiast! Solid-state MW/SW/FM facilities. 100 watts music power with exceptionally low distortion. Piano-touch selection; slide-rule control of volume, tone and balance for really smooth operation.

SAVE $52.60 ON STANDARD SR-T186F

FM/MW/SW 3 Band Radio Cassette Tape Recorder with Mic-mixing. Unbelievable value!

$129 (LIST: $181.60)

OTHER ALLIED SPECIALS

AIKO ATP701
Solid State AC/DC Slide Control Push Button High Quality Cassette Recorder
No other similar machine can perform like this one for so little money!

ONLY **$59**

TEMPO $59
8 TRACK STEREO CARTRIDGE CAR PLAYER
Plus matched speakers from **$15** a pair (depending on type of car)

SYDNEY'S BIGGEST RANGE OF SOUND EQUIPMENT —AT THE LOWEST PRICES ANYWHERE!

EASY PAYMENT. Terms available on all equipment at Allied. Also lay-by.
TRADE-INS WELCOME. Everyone says it. We really mean it. And we give you top prices. Try us.
SOUND ADVICE. At Allied you'll get the best—and most straightforward and expert advice on every sound equipment problem.
AFTER-SALES SERVICE. Fast, reliable, low-priced.
FREE INSTALLATION. At Allied, delivery and installation of mains equipment is **absolutely free.**

210 Clarence Street, Sydney. 29 1704.
330 Pacific Highway, Crows Nest. 439 1072

Allied Music Systems
Allied

SEND FOR MORE DETAILS, OR THE LATEST ALLIED CATALOGUE
Complete today and mail to:—

ALLIED MUSIC SYSTEMS,
210 Clarence Street, Sydney,
New South Wales 2000.
Please send me, by return mail, free illustrated literature on..
....
Check here for your FREE ALLIED Catalogue. ☐
NAME..
ADDRESS..
....
.... STATE............ POSTCODE..............
PHONE NUMBER.................................... AMS.3

PRODUCT REVIEWS AND RELEASES

Harman Kardon CAD-5 Cassette Deck

The Harman Kardon CAD-5 is a high quality stereo cassette deck incorporating the Dolby "B" system of noise reduction. It is suitable for both conventional and chromium dioxide tapes. Our sample was submitted for review by Recorded Music Salon, of Melbourne.

As with the Harman Kardon 330 Stereo amplifier reviewed in these columns in February of this year, the CAD-5 cassette deck is manufactured in Japan. It is very compact and is probably one of the smallest cassette stereo decks on the market. Dimensions are 12¾(w) x 9(d) x 3¼(h) inches (or 324 x 229 x 79mm). Weight is 10 pounds (4.5 Kg).

The case is simulated teak with timber endplates. There are six push-buttons to control the transport mechanism, as follows: Record, Stop and cassette eject, Play, Fast forward, Pause. To record, the Record and Play buttons are pushed simultaneously. Four indicator lights are provided. The "record" indicator lights red when recording is in progress. The "auto" light is green and is alight when the transport is running. At the end of a cassette, the motor switches off and the light is extinguished.

The "Dolby" light is blue and indicates when the Dolby noise reduction system is in use. The lights so far mentioned and the twin VU meter illumination are rather dull being hard to see in all but dimly lit rooms. By contrast, the orange "overload" light is very bright. It is lit whenever the input signal being recorded exceeds +2VU, on either channel.

To the right of the push-buttons is the twin VU meter. This is easy to read, although we found the calibrations were a little inaccurate. Next to the meters are two slide potentiometers for the control of input signal levels. These are very smooth and appropriate for this type of use. At the extreme right are two rocker switches, one to switch the power and other to energise the Dolby function. A rocker switch on the extreme left is a mono / stereo selector for input signals. Two microphone sockets (600 ohm), one for each channel are provided below the push-buttons.

A resettable 3-digit revolution counter is positioned just behind the cassette well. It may be used for cueing and is quite accurate.

On the rear panel, there are three sets of phono sockets. One pair is for replay and has an output level of 950mV at 0 VU. The other two pairs are low and high level inputs, 200mV and 600mV. A push button is provided to adjust the bias level to suit conventional or chromium dioxide tapes.

There are four holes to provide screwdriver access to potentiometer adjustments for correct adjustment of record and playback levels. The play back levels are preset at the factory but if they do require adjustment it is necessary to obtain a Dolby level setting tape. The record levels are set with the aid of a test tone which is provided by a "hold-on" push button on the rear panel.

The cassette is dropped on the loading platform and then pressed into place by hand or using the smoked plastic dust cover. Harman Kardon recommend that the dust cover be normally closed but under normal conditions we found cassette visibility poor. The cassette is ejected by pushing the stop button.

The interior of the CAD-5 is very tightly packed with circuitry. The power transformer is mounted in a relatively roomy sub-compartment to provide good shielding. A low voltage DC motor is used, to make the unit independent of line frequency variations.

The Harman Kardon CAD-5 cassette deck with cassette cover opened.

The CAD-5 operates very quietly and the only time one is aware that it is running is during rewind or fast forward. No electrical noise, such as motor noise or clicks, is fed through to the following amplifier. The push-buttons were stiff to operate, especially the play button.

Listening tests confirm the advantages of the Dolby system. We recorded some discs on Chromium Dioxide tapes and found the results very good. It is possible to distinguish the difference between the recorded tape and the original disc, but this will depend on the acuity of the listener's ears. The differences are a slight increase in hiss and slight degradation in the high frequency response. Most people will regard the results as very good.

We made a number of record-to-playback frequency response tests using various types of tape, both chromium dioxide and conventional low noise. Chromium dioxide tapes easily exceed the performance of conventional tapes. At signal levels of —10 VU or below the response is within + 2dB from 40Hz to 13kHz. With conventional low noise tapes, the best we could achieve was + 3dB from 40Hz to 7kHz.

With Dolby operation, signal to noise ratio with respect to VU is better than -50dB which is approaching the best performance of domestic open reel recorders. Crosstalk with respect to 0 VU ranges from -30dB at 10kHz to -36dB at 100Hz. Harmonic distortion at 0 VU was 1.5% as specified and at lower signal levels, ie, -10 VU, it was less than 1%. These figures clearly demonstrate just how good Dolbyised machines can be.

These advantages come at a price. At $319, the Harman Kardon CAD-5 must be considered expensive, especially since it is made in Japan. But no doubt those who buy it will be completely satisfied.

Harman Kardon equipment is available from retail outlets throughout Australia. All enquiries should be directed to Recorded Music Salon, 11 Collins Street, Melbourne, Victoria, 3000. (L.D.S.).

Dana Electronic Counter

Dana Laboratories have released a new range of electronic counters designated the 8000B series. They have frequency measurement capability up to 550MHz. Australian distributors are Jacoby, Mitchell & Co Pty Ltd.

Each counter provides four measurement modes: frequency, period, multiple period average and totalise. Four additional modes are available on some models: an extended frequency range to 550MHz, time interval, average time interval and frequency ratio.

A temperature-compensated crystal oscillator (TXCO) is used as the reference to eliminate long warm-up delays and to obtain optimum accuracy. A higher stability TXCO and a range of oven-controlled oscillators are available as options.

Input sensitivity is normally 50mV up to 550MHz. An optional amplifier increases this 1mV with automatic triggering. This high sensitivity allows frequency measurements of signals having up to 99% amplitude modulation.

Further information can be obtained from the Australian distributors for Dana equipment, Jacoby Mitchell & Co Pty Ltd, P.O. Box 2009, North Parramatta, NSW 2151.

Dana electronic counters have frequency measurement capability up to 550MHz.

Sansui SD-5000 Tape Deck

Sansui Electric Co Ltd recently announced the release of the new SD-5000 three-motor, four-head tape deck. It has been designed with special emphasis on tonal quality, tape protection and operating convenience. It is distributed in Australia by Simon Gray Pty Ltd.

Apart from the features mentioned above, Sansui engineers have given special attention to mechanical ruggedness of the recorder. A case in point is aluminium die-cast base for the tape transport which because of advances in die-casting and new materials, is exceptionally rigid. Much attention has also been paid to ease of service and little dismantling is necessary to obtain access to major sections.

Features of the tape transport system include relay-actuated, interlocked controls incorporating an electronic delay to eliminate tape snatch, twin 6-pole induction motors for reel drive and a hysteresis-synchronous 4 8 pole motor for capstan drive.

The recording and playback heads are exceptionally large to ensure large signal-handling capability and a smooth extended bass response. Similarly, the equalisation preamplifiers have excellent signal handling capability and a high level of negative feedback to minimise distortion.

Mixing facilities are provided for microphone and line inputs. Control features include automatic reverse, remote control, echo recording, pause control and cue button.

Other tape decks in the Sansui range are the SD-7000 professional quality open-reel deck and the SC-700 Dolbyised cassette deck. Recommended retail price of the SD-5000 tape deck is $756 including sales tax. Further information on these Sansui tape machines may be obtained from the Australian distributors, Simon Gray Pty Ltd, 28 Elizabeth Street, Melbourne, Victoria 3000.

Australian made semiconductors from ITT

Standard Telephones and Cables Pty Ltd now have available a new ITT range of Australian made semiconductors. Included in the range are 3-amp rectifier diodes, triacs, silicon controlled-rectifiers, uni junction transistors and a bidirectional trigger diode (diac).

The 3-amp rectifier diodes are IN4719 to IN4725 (axial lead) and IN4997 to IN5003 (single-ended mounting). Peak repetitive reverse voltage ratings are 50, 100, 200, 400, 600, 800 and 1000 volts. DC reverse current at rated reverse voltage is a maximum of 0.5mA at 25°C ambient. Non-repetitive peak surge current is 300 amps for ½cycle at 50Hz. Operating case temperature ranges from -65 to 175°C.

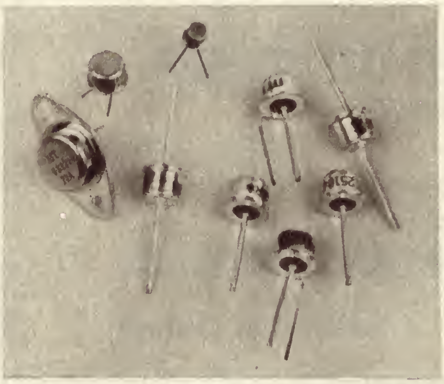
Triacs are available with three current ratings, 1, 6 and 10 amps RMS. The 1-amp type is the TC1101. This has a metal TO-8 encapsulation and a repetitive peak off-state voltage rating of 400 volts, making it suitable for low power 240V AC operation. The 6 and 10 amp types are the TC1102 and TC1103, respectively. These have TO-66 encapsulation and are also suitable for 240V AC operation. They are direct replacements for the superseded AC06DR(T) and AC10DR(T) triacs.

The silicon controlled-rectifiers are available in two current ratings, 1.6 and 10 amps RMS. Average current ratings are reduced, depending on the conduction angle. The 1.6 amp range is designated TS1201 to TS1205 and has metal TO-5 encapsulation. Repetitive peak off-state voltage ratings are 50, 100, 200, 400 and 500 volts.

The 10-amp SCR's are designated TS1216 to TS1220 and have TO-66 encapsulation. Repetitive peak off-state voltage ratings are the same as for the 1.6 amp unit listed above. Non-repetitive surge current rating for the 10-amp units is 80 amps for 10 milliseconds. Maximum operating junction temperature for all the SCR's is 100 C.

Triggering circuits for the Triacs and SCR's may be designed around the bi-directional diode V413 or the unijunction transistors 2N2646 and 2N2647 which are now manufactured locally by ITT so that continuity of supply is assured.

Further information on the complete ITT range of Australian-made semiconductors may be obtained



from Standard Telephones and Cables Pty Ltd, Moorebank Avenue, Liverpool, NSW 2170 or their interstate distributors.

SONAB DEMONSTRATION

Sonab of Sweden Pty Ltd is offering appointed Sonab dealers the services of a trained demonstrator to promote the range of Sonab loudspeakers and equipment. All information can be obtained by contacting Sonab at 929 4288 or 929 4554.

Peak integrated circuit stereo amplifier

Peak amplifiers have been on the Australian market for many years and are probably well-known to most enthusiasts. One of the latest models is the Peak TRM-50 which has rated power output of 18 watts per channel. Apart from the four output transistors, all circuitry uses integrated circuits.

Overall dimensions of the Peak TRM-50 are 13(w) x 10(d) x 4¼(h) inches (or 330 x 254 x 107mm) including knobs and rubber feet. It has a vinyl-covered steel top cover and oiled walnut end covers. The extruded aluminium front panel is finished in matt black and natural aluminium and is rather "busy" with six knobs and four lever switches.

From the left, the knobs are loudspeaker selector, bass and treble controls, balance, volume and input selector. The loudspeaker selector gives a choice of both or either of two loudspeaker systems or they may both be switched off. The bass control knob pushes in to switch in a rumble filter and similarly, the treble control knob pushes in to operate a high filter which is erroneously labelled a "scratch" filter.

From left, the lever switches provide the following functions: Stereo mono selector, Tape monitor, Loudness and Power. The stereo headphone socket and pilot light complete the list of front panel features.

The rear panel has several interesting features, such as the three red push-buttons for the re-settable circuit breakers. These act to protect the amplifier in the case of an unacceptable load, such as a short-circuit or in the case of an internal component breakdown. One circuit breaker is in series with the transformer primary. The other two are in series with the positive DC supply line to each power amplifier.

Spring-loaded terminals are provided for two sets of loudspeakers. Two 2-pin mains outlets are provided, one switched, one unswitched. Four pairs of phono sockets are provided, for magnetic cartridge, tuner, tape and auxiliary inputs. A 5-pin DIN socket is provided for tape-recorder connection and this facility is duplicated with two pairs of phono sockets.

There are two printed boards inside the amplifier, one large and one small. The small board measures about 7 x 2 inches and accommodates the tone control and filter circuitry. It is mounted upside down and the potentiometers are soldered directly to it. This is a common feature these days but it does tend to make servicing in this section a little difficult.

The large board accommodates the circuitry for both power amplifiers, together with the magnetic equalisation preamplifier. The four output transistors, which have a metal TO-66 encapsulation, are mounted together with their U-shaped heatsinks directly on the board. Apart from the output transistors, there are no discrete transistors in the unit. Instead, there are six IC's, one in each power amplifier, one in each channel of the magnetic cartridge preamplifier and one in each channel of the tone control circuitry.

To keep wires carrying low-level signals are short as possible, the input selector switch is mounted at the rear of the amplifier, adjacent to the input sockets. A long shaft runs from it to the input selector knob in the front panel.

A generously sized power transformer, two silicon diodes and a 1000uF capacitor make up the power supply. Further resistors and electrolytic capacitors provide decoupled supply rails for the low-level sections of the amplifier.

The amplifier output configuration is the familiar quasi-complementary mode and output signal coupling is via 1000uF 35VW electrolytic capacitors, one per channel. These seem a little small, specially for operation with 4-ohm loads. Unfortunately, we did not have a circuit diagram for reference at the time of writing, so further comments on the circuit are not possible.

All the controls operate smoothly and the lever switches have a very good "snap" action. The spring-loaded loudspeaker terminals are certainly an improvement on the normal screw terminals seen on many amplifiers.

During listening tests the amplifier performed well in most respects. We did notice that taxi-operator conversations could be heard very faintly in the background when the gain was well advanced but this should not be a problem in most areas. The strong radar signals which were evident in our area did not give any problems.

Listening tests with a magnetic cartridge and a pair of good quality loudspeakers gave the impression that the amplifier was slightly deficient at the bass end. This was not entirely dispelled by subsequent measurements.

Continuous power ouptut into 16 ohm loads was 10.5 watts at 1KHz for one channel, or 10 watts per channel with both channels driven. At this power level, harmonic distortion was 0.3%. Power output into 8-ohm loads was 18 watts with one channel driven and 15 watts per channel with both driven. Harmonic distortion was 0.4%. Into 4-ohm loads, continuous power was 21 watts with one channel driven, and 13 watts per channel with both.

Separation between channels with respect to 15 watts into 8-ohms was -41dB at 1kHz and -55dB at 10kHz. These figures are very good. Frequency response at a level of 1 watt results in -3dB points at 20Hz and 70kHz. Bass and treble boost and cut is +11dB or -12dB at 10kHz and +12 or -15dB at 50Hz.

Square wave response was good. Signal-to-noise ratio was -70dB with respect to 15 watts with open-circuit inputs and -73dB with short circuit inputs. These figures are unweighted. All the above measurements were made using the auxiliary input which has a sensitivity of 300mV at 100K. Sensitivity drops by 6dB when the mono lever switch is depressed.

Stability is marginal under some conditions. With capacitances of between 0.05 and 0.15uF shunting the load and treble boost applied, bursts of RF oscillation are superimposed on the waveform. While it is a marginal condition it should really be remedied as it can be a source of unreliability.

Sensitivity of the magnetic cartridge input is 2.4mV at 1kHz for 18 watts into 8 ohms. The equalisation conforms closely to the RIAA curve except at the bass end. At 50Hz, the equalisation is -3dB down. This partly explains our impression of bass deficiency although we would not have thought that such a small deviation would be very noticeable.

The overload capability of the magnetic input is adequate. It can handle 50mV at 1kHz or 200mV at 10kHz. Signal-to-noise ratio with respect to 15 watts was 60dB regardless of whether the input was loaded or not.

The method of short-circuit protection appears to be foolproof. Overdriving the amplifier into low value loads or short circuits rapidly trips the appropriate circuit breaker.

In conclusion, the Peak TRM-50 can be described as an easy to use amplifier conforming closely to its specification. Apart from the remarks on stability it is hard to fault. At the recommended retail price of $195 it is very reasonable buying.

Peak amplifiers are availble from slected retail outlets throughout Australia. All enquiries for Peak products should be directed to the Australian distributors, H. Rowe and Co Pty Ltd, 8 Rich Street, Marrickville, NSW 2204. (L.D.S.)

Jabel Mains Interference Filter

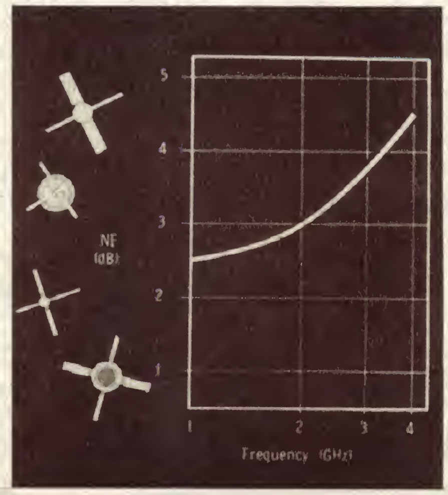
Watkin Wynne Pty Ltd announce the release of the Jabel F500 radio interference filter for mains operated domestic appliances. It contains an iron-cored inductor and a delta-configuration of 600 volt capacitors.

The unit has a current rating of 2 amps, making it suitable for electronic organs and other appliances with power consumption up to 500 watts. Depending on how the interference is radiated, the filter can effect a major improvement to radio reception and sound reproduction.

Trade price of the F500 is $8.00 plus tax, for small numbers. The unit is available from trade outlets or from Watkin Wynne Pty Ltd, 32 Falcon Street, Crows Nest, NSW 2065.

Hewlett-Packard Microwave Transistors

A range of low-noise microwave transistors is now available from Hewlett-Packard at prices less than half those previously applying. Designated the HP 21A series, they have "worst case" noise figures of 4.5dB at 4GHz and 3dB at 2GHz.



The new HP21A series exhibit exactly the same smooth matching characteristics as the current HP21 series. In fact, the only difference is that the HP21A series have arsenic emitters.

Data sheets are available giving thorough specifications, including s-parameter information and source-matching impedance at the low noise biasing levels (10V, 5mA). The transistors come in 200-mil, 70-mil and 130-mil four-lead common-emitter strip-line packages. Offered at the same time are transistors with 0.5dB higher noise figures.

Further information can be obtained from Hewlett-Packard Australia Pty Ltd, 22-26 Weir Street, Glen Iris, Vic 3147 or 61 Alexander Street, Crows Nest, NSW 2065.

Test Equipment from Schlumberger

Schlumberger Instrumentation Australia Pty Ltd have recently released three new instruments, the FB 2003/0 Digital Counter, the TH5611 Multiplexer/A-D Converter and OCT 461 transistorised oscilloscope.

The Schlumberger SIS Digital Counter FB 2003 0, with a bandwidth of 0-40MHz, measures frequency, periods, multiple periods, positive or negative pulse duration, duration of a short circuit and time intervals with a stability of 3 parts in 100 million. High reliability is achieved with TTL integrated circuits and the 6 digit display is enhanced by the use of non-blinking indicator tubes.

Various add-on modules are available to increase the flexibility of the counter: a 160MHz divider, a 520MHz divider, a voltage to frequency converter and a drift expander.

The TH 5611 Multiplexer and Analog-to-Digital Converter multiplexes and samples up to 64 inputs. The sample rate, number of channels, etc, can be selected manually by front panel controls or can be selected automatically by a central processor or remote control device. The 5611 can be integrated into an automatic data processing system.

Up to eight plug-in cards can be included in the multiplexer and each can include up to 8 FET analog switches. The multiplexed output is routed via an amplifier for impedance and level adaption. The conversion time for 11 bits is less than 5uS, regardless of the selected sample rate. The output of the analog to binary converter is transferred to two buffers: one for the series output and one for the parallel output.

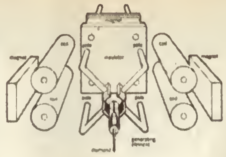
The OCT 461 transistorised oscilloscope weighs 13 pounds (6Kg) and is designed to operate from AC or DC power sources. An accessory battery pack gives up to eight hours use. Band-width of the OCT 461 is DC to 10MHz at 1mV cm sensitivity. Comprehensive time-base facilities include TV line and field synchronisation, X expansion and automatic stability control. Screen size is 54mm x 68mm and overall dimensions are 12 x 12 x 4½ inches (305 x 305 x 114mm).

For further information, contact Schlumberger Instrumentation Australia Pty Ltd, P.O. Box 138, Kew, Victoria, 3101.

TRADE RELEASES — in brief

SIEMENS INDUSTRIES LTD, 544 Church Street, Richmond, Vic 3121. **Linear ICs**, types TAA 981 and 991, TBA 120 and 140. The TAA 981 and 991 are combined AM FM IF amplifiers for use in radio receivers. The 991 has an AGC output, otherwise the two types are identical. The IF amplifier circuit consists of two stages directly coupled by an emitter follower. The operating points are stabilised by feedback. FM limiting is at an input voltage of 200uV; the AM suppression factor is 50dB; and the supply current drain is only 6mA. The TBA 120 and 140 are FM IF amplifiers primarily for use as TV sound or FM broadcast IF amplifiers. They operate to 40MHz and can be used as limiting amplifiers, controlled demodulators and modulators. Limiting begins at 70uV and AM suppression is better than 60dB at 10mV.

ALL CARTRIDGES ARE DIFFERENT. EMPIRE CARTRIDGES ARE MORE DIFFERENT THAN OTHERS.



They are undisputably the best in the world.

If you know how moving magnetic cartridges are made, you can see right away just how different an Empire variable reluctance cartridge is. With the others, the magnet is attached directly to the stylus — so all that extra weight rests on your record.
With Empire's construction, (unique of its type), the stylus floats free of the magnets. So, naturally, it imposes much less weight on the record surface.

Less record wear
Empire's lightweight tracking ability means less wear on the stylus and less wear on your records. Some experts claim that an Empire cartridge can give as much as **50 times the number of plays** you'd get from an ordinary cartridge without any measurable record wear! "A real hi-fi masterpiece . . . A remarkable cartridge unlikely to wear out discs any more rapidly than a feather held lightly against the spinning groove." **Hi-Fi Sound** on the 999 VE.

Superb performance
The lightweight Empire cartridge picks up the recorded sound from the grooves with amazing accuracy. Distortion is minimal (one reviewer could measure no distortion at all levels on the 1000ZE/ X and 999VE/ X). Separation is razor sharp. (Audio Magazine said "Outstanding square waves. Tops in separation".) And frequency response is outstanding. (4-40,000Hz on the 1000ZE/ X).

empire **Empire cartridges are different And all the better for it.**

We refer to the most Authoritative Products reviewed in "Electronics Australia" March, 1972. Pages 100 and 105, as quoted below.

Empire 1000ZE/ X Magnetic Cartridge

Over the past few years manufacturers' top-of-the-line pickup cartridges have become increasingly expensive but at the same time their performance has been much improved. The 1000ZE / X is the top of the Empire line and few cartridges can compare with it.

As with most things, high fidelity equipment conforms to the law of diminishing returns — "the more you pay, the more subtle the improvement becomes". But the Empire 1000ZE/ X seems to be the exception that proves the rule. It is audibly better than the other cartridges in the Empire range, and most of those of other manufacturers.

The 1000ZE / X has a moulded plastic body and a removable stylus assembly which incorporates a flip-down stylus guard. Finish is black and gold. Mu-metal shielding and hum-bucking connection of the four internal coils result in a cartridge with very low residual noise output. Cartridge weight is 7 grams.

ARMSTRONG 526

"Best buys of the day"

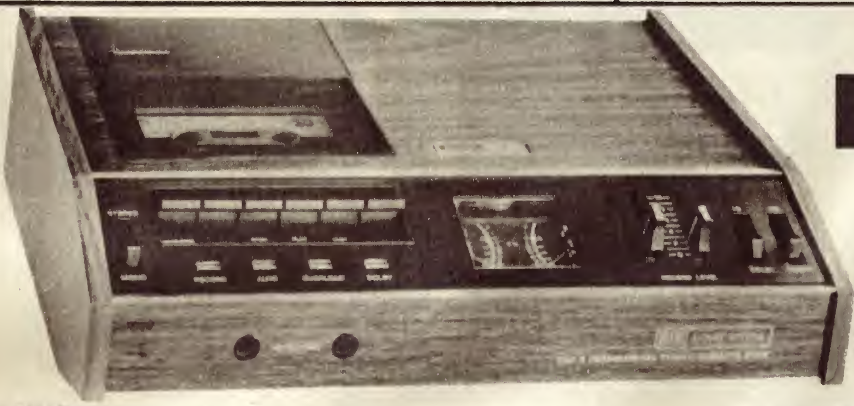
AMPLIFIER: Power Output: 25 watts R.M.S. each channel into 8 ohms. **Frequency Response:** 20-20,000Hz ± 1dB. **Total Harmonic Distortion:** Less than 0.5% for power levels up to 25 watts throughout the audio range. **Crosstalk:** Better than —40dB. **Hum and Noise:** Better than —70dB on tape playback, —60dB on radio and —55dB on pickup. **FM TUNER: Coverage:** 86-109mHz. **AM TUNER: Coverage:** Medium and Long wavebands. **If Bandwidth:** 4kHz at 6dB down.

ERA

THE WORLD'S BEST TURNTABLE WHICH TRACKS AT 1/10th OF A GRAMME

- The **ERA** arm outperforms even the most recent cartridges: it can track at 1/10th of a gram.
- By principle its pivot eliminates all factions. The pivot is in fact the intersection of the counter-balanced spring blades. They form two Xs which do not touch each other.
- The tracking weight is applied directly to the pivot by changing the angles of the blades; in this way the inertia of the arm is not increased with the tracking force as in all other arms. The pick-ups sound better.
- The arm itself is made of a light alloy H beam which eliminates the resonant frequencies of tubes.
- 35-45 rpm stop between speeds.
- Hydraulic arm lift.
- Total wow and flutter 0.04%.
- Slide-in head for all pick-ups.
- 12 pounds.
- 50 to 60 cycles.
- Power requirements 1.6 watts.
- 22 cms arm.
- The motor of the ERA turntable rotates so regularly that it does not need a heavy platter. It is belt-driven to avoid flat spots.
  The ERA motor is synchronous. Its speed is rigorously stable because it is keyed to the frequency of the AC current.
- The oversized ERA motor allows fast-starts. Its work load is well within its possibilities since it could drive a 30-pound weight.
- As in all professional turntables the drive is through a belt. It is made of a special neoprene and ground to its specifications within 0.002 of an inch. The simplicity of this one-step drive eliminates wow and flutter.

SUPERIOR SUSPENSION: While listening to a record, hit vertically the turntable with your knuckles; the arm does not jump one groove.
Made in France.



harman kardon

The Harman -Kardon CAD5

SPECIFICATIONS

Tape Speed: 1-7/8 IPS
THD: Less than 1.5%
Speed Variation: Within 1%.
Wow and Flutter: 0.15% RMS at 1-7/8 IPS.
Frequency Response: +2dB below 30 to beyond 12,500 hertz.
Signal To Noise: Better than 55dB weighted below zero VU.
Bias Oscillator Frequency: 105kHz.
Crosstalk: 40dB.
Record/ Playback Output: 1 volt.
Erasure: Better than 55dB.
High Level Input Sensitivity: 200 mv. ±2dB for zero VU.
High Level Input Impedance: 200k ohms.
Dimensions: 12½"W x 9"D x 3¼"H.
Weight: 10 pounds.

PROFESSIONAL TAPE CASSETTE RECORDER WITH BUILT-IN DOLBY NOISE REDUCTION PROCESSOR

The Dolby B system employed in the Harman-Kardon CAD5 operates on both record and playback. It boosts low-level high frequency signals prior to recording, then attenuates these same signals in a precisely equalized mirror image during playback. When this is accomplished, all of the additional noise that may have been added after the fact is reduced to a level below audibility.
Harman-Kardon, long an industry leader in advancing the state of the art, has made the Dolby noise reduction process an integral part of the new CAD5 tape cassette deck. The result is an incredible boost in bandwidth and dynamic range.

Sole Agents for Australia
RECORDED MUSIC SALON
(C. Pinczewski)

11 Collins Street, MELBOURNE, VIC 3000. Tel. 63-6257

WARBURTON FRANKI PTY LTD, PO Box 182, Chatswood, NSW 2067. Agent for Farnell Instruments Ltd, UK. **RF millivoltmeter.** This is a general purpose instrument with a frequency range from 50KHz to 1.5GHz, and can give useful indications up to 2GHz. It provides FSD readings from 1mV RMS to 3V RMS or, with a multiplier switched in, to 300V RMS. Accuracy from 2MHz to 200MHz is +5% of full scale for the 1mV and 3mV ranges, and +3% on other ranges.

3M COMPANY, 950 Pacific Highway, Pymble, NSW 2073. **Magnetic tape viewer**, the "Plastiform". Designed to provide a simple, fast means of viewing recorded signals on magnetic tape without the use of chemicals, the viewer is placed on the tape to view recorded signals for head alignment, track placement, pulse definition, interblock spacing, and dropout areas. It can also be used to help determine record or reproduce problems in malfunctioning systems. It can be used to synchronise the audio track on a video recorder, to examine the pattern of recorded sound in audible range applications, and to determine whether tools, heads or guides are magnetised.

When the Plastiform magnetic tape viewer is placed on recording tape, the magnetic field pattern forms a clear image.

AUSTRALIAN VIDEO ENGINEERING, 7 The Crescent, Annandale, NSW 2038. Agent for ITC Ikegami, Japan. **Videotape recorder**, model TVR-41E. This unit uses standard ½in tapes and has been designed for interchange of tapes with other EIAJ machines — EIAJ is the new Japanese standard format. The recorder features push-button operation, full remote control possible, tape speed of 6½ips for 71 minutes recording.

Also agent for Dynasciences Corp, USA. **Editor-programmer.** Claimed to be compatible with most VTR equipment, this unit provides a means of performing tape-to-tape assemble and insert editing with ½in helical scan units to 2in quadruplex machines.

RACAL ELECTRONICS PTY LTD, 47 Talavera Road, North Ryde, NSW 2113. **HF SSB Transceiver**, model TRA 7928. Provides six (optionally 12) high stability crystal controlled channels which may be located anywhere in the range 2-10MHz. Using silicon solid-state circuitry (including ICs) throughout, the

transmitter has a PEP output of 25W. It is able to operate into any load from a short circuit to an open circuit without damage. It operates from a 12V DC source of either polarity, and an optional external AC supply is available.

FAIRCHILD AUSTRALIA PTY LTD, PO Box 151, Croydon, Vic 3136. **Triple line driver**, type 9616, and **receiver**, type 9617. Together these devices offer a simple, low-cost method of interfacing DTL TTL data terminal and communications equipment. The 9616 is implemented by an AND OR Invert function instead of the positive NAND function used in other drivers. It also features internal slew rate control which eliminates the need for an external capacitor for each driver. The 9617 has 3 to 7K input resistance and protection to +25V. It offers control of slicing or hysteresis operation and has individual response control pins to allow increased AC noise immunity.

EMI (AUSTRALIA) LTD, 301 Castlereagh Street, Sydney, 2000. Agent for EMI Electronics, UK. **Photomultiplier tube**, type 9558F. This is for use in colour flying spot film scanning applications where relatively high light levels are involved. Intended for use in the blue and green channels, the 9558F extends the EMI range of tubes with S20 photocathodes. The S20 photocathode has intrinsic properties which help reduce picture shading by improving linearity and pulse shape over a wide range of light levels.

THORN ELECTRICAL INDUSTRIES (AUST) PTY LTD, 121-131 Barnfield Road, West Heidelberg, Vic 3081. Agent for Goodmans Loudspeakers Ltd, UK. **Bi-directional sound source.** The design and arrangement of drive units in this loudspeaker system provide bi-directional sound sources as distinct from the uni-directional or omni-directional, behaviour of most domestic stereo systems. Nine matched drive units (four bass units, two mid-range units, two high-frequency dome radiators, and a 12in parasitic low-bass resonator) are fitted in each of the two cabinets comprising the system. The units are integrated by a crossover network of close-tolerance components. Small-cone loudspeakers are used throughout to prevent cone break-up distortion. The frequency range is 30Hz to 22KHz, the nominal power output is 60W, sensitivity is 4W, and impedance is 4 ohms. The speaker cabinets measure 30⅝ x 14 x 12½in and weigh 44lb.

McMURDO (AUSTRALIA) PTY LTD, PO Box 321, Clayton, Vic 3168. **Edge connectors**, ERL series. Available in 0.1 and 0.15in pitch. These low insertion force connectors feature a "rolling leaf" contact which permits a wide variety of printed wiring board thicknesses to be used without inducing excessive contact pressures. Solder, PC tails, and wire-wrap tails are available. The range covers 8 to 85 ways, single sided, and 16 to 170 ways, double sided in 0.1in pitch; and up to 40 ways, single sided, and up to 80 ways, double sided, in 0.15in pitch. Standard contact finish is "Tintillate" or gold.

E. S. RUBIN & CO PTY LTD, 73 Whiting Street, Artarmon, NSW 2064. **Indicating pushbuttons and switches**, series 1.15107. These are available in both locking and non-locking forms with rectangular (18mm x 25mm), square (18mm x 18mm) or circular (18mm diam) bezels. Lenses are available transparent, clear,

red, yellow or green. Contact arrangements are: 2 normally open; 2 normally closed; 1 normally open, 1 normally closed; 2 normally open, 2 normally closed. The switches are rated at 250V AC and 2A maximum. The switching capacity is 50W maximum.

SCHLUMBERGER INSTRUMENTATION AUST PTY LTD, PO Box 138, Kew, Vic 3101. **Correlators**, models CNTR 1024 CTR 100A and CTR 200 HF. All models compute, in real time, the correlation between two input signals (or between one input signal and itself) as a function of the time delay between the signals. Model CNTR 1024 computes simultaneously either 256, 512 or 1024 points of the cross or auto-correlation curve over a frequency range from DC to 25kHz with the incremental delay having a value

TRANSISTOR STEREO AMPLIFIERS WITH IN-BUILT AM TUNER
ULTIMATE IN DESIGN — LONG DEPENDABILITY

USING ALL SILICON TRANSISTORS 40 WATTS — RMS

SPECIFICATIONS:
20 watts per channel RMS.
Total output 40 watts RMS.
FREQUENCY RESPONSE:
From 20 to 20,000Hz ± 1dB.
HARMONIC DISTORTION:
Less than 1 per cent of rated output.
HUM AND NOISE:
Aux 70dB, Mag 50dB.
INPUT SENSITIVITY:
Mag 3mV, Aux 200mV.
SPEAKER IMPEDANCE: 8 ohms.
EQUALISED: Mag RIAA.
TONE CONTROLS: Bass, 50Hz ± 12dB; Treble, 10KHz ± 12dB.
LOUDNESS CONTROL: 50Hz 10dB.
SCRATCH FILTER:
(High filter) at 10KHz 9dB.
RUMBLE FILTER:
(Low filter) at 50Hz 5dB.
PROVISION FOR TAPE RECORDER: Record or playback with DIN plug connection.
PROVISION FOR HEADPHONES: With headphone/speaker switch on front panel.
DIMENSIONS: 16½ x 5½ x 11in deep.
TUNER: This unit can be supplied with either valve or transistor tuner with a coverage of 530 to 1600 KHz. Calibrated dial available for all states.
THE CIRCUIT incorporates regulated power supply with transistor switching protection for output transistors. 26 silicon transistors plus 5 diodes are used.

$134.00

PLUS FREIGHT
(CABINET EXTRA)

MODEL C300/20/T
(with Tuner)

$108.00

PLUS FREIGHT
(CABINET EXTRA)

AMPLIFIER ONLY.
Specifications as above but with the added feature of front panel switch which allows selection of two speaker systems.

MODEL C400/20

Cabinets for above in teak or walnut with metal trim, $10 extra.

THE NEW MAGNAVOX 8-30 SPEAKER SYSTEM

Complete System (1.6 cubic ft.) in Walnut or Teak Veneer, Oiled Finish. (regret no mail orders for complete system.) —— **$60.00**
Speaker Kit (less cabinets) COMPRISING 1-8/30 Speaker, 2-3TC Tweeters, 1-3in. Tube, 1-4 or 2uF Condenser, Innerbond and Speaker Silk Available in 8 or 15 ohms. Postage $1.50 extra. **$29.50.**

NEW 6 WATT STEREO AMPLIFIER WITH A.M. TUNER

$88.00

FREIGHT & PACKING EXTRA
N.S.W. $1.75
Interstate $2.75.
Dimensions 12½" x 3½" x 9" deep

A high quality stereo amplifier incorporating the new Plessey SL403D I.C. audio amplifiers with separate bass and treble controls with inbuilt high gain A.M. tuner giving a coverage of 530 to 1600KHz with calibrated dial available for all States. Timber cabinet available in teak or walnut oiled finish.

SPECIFICATIONS:
DISTORTION:
Less than 1.5 per cent THD at 1KHz, less than 0.5 per cent at 100mW at 1KHz.
SIGNAL TO NOISE RATIO:
-62dB with respect to 3 watts into 8ohms.
FREQUENCY RESPONSE:
Within 2dB from 20Hz to 100KHz.
TONE CONTROLS:
Bass control 15dB boost or cut at 50Hz, treble control 14dB boost or cut at 10KHz.
INPUT SENSITIVITY:
250mV for all imputs, tape, aux. or phono.
SHORT CIRCUIT PROTECTION.

Above amplifier tuner supplies with two Magnavox 8WRMkV speakers, two 3TC tweeters, 2 4mfd. condensers and Garrard SRP22 record player with Sonatone ceramic cartridge.
Details of speaker cabinet with innerbond and speaker silk supplied. **$138.00** ***FREIGHT EXTRA***

TRANSISTOR AM TUNER WITH PREAMPLIFIER

Suitable for use with all valve or transistor Hi-Fi amplifiers, tape recorders or PA amplifiers

SPECIFICATIONS

Frequency coverage 530 to 1600KHz, bandwith 9KHz. Inbuilt aerial, provision for external aerial. 240V AC operation. Dimensions 10¾ x 6 x 3½ins. Output variable from 50mV to 700mV.

$49.00

Post and packing $1.50

CLASSIC RADIO

245 PARRAMATTA ROAD, HABERFIELD, 2045 N.S.W. PHONE 798 7145

variable from 10us to 100s, and total delay span from 2560us to 1024,000s. Model CTR 100A computes simultaneously 100 points over a frequency range from DC to 500kHz with incremental delay variable from 0.5us to 0.45s, and total delay span variable from 50us to 45s. Pre-computational delay facilities up to 1050 points are also available as an option. Model CTR 200 HF computes 200 points over a frequency range from DC to 2.5MHz. Models CNTR 1024 and CTR 100A are complemented by their appropriate Fourier transformers, models TFN 1024 and TF 200.

HEWLETT-PACKARD AUST PTY LTD, 22-26 Weir Street, Glen Iris, Vic 3146. **Signal generator**, model 8654A. This compact, portable instrument, with a frequency range of 10 to 512MHz, is suitable for testing receivers, amplifiers, etc in the laboratory or on the production line. It generates power levels between +3dB AND -120dB (into a 50-ohm load) over its full frequency range. The power output is accurate within $\pm$1.5dB plus attenuator accuracy ($\pm$0.5dB in the 10 to 50dB range; $\pm$1.5dB in the 60 to 120dB range). A front panel meter displays the output level in dBm and volts.

Frequency stability is 20ppm over a 5m operating period after a one-hour warm-up. Typically, it recovers specified accuracy within 5m following a frequency band change. The accuracy is $\pm$2% after 30m warm-up, and residual FM is less than 0.5ppm. Internal 400Hz and 1KHz oscillators are available for AM or FM, and external modulation can be used.

McMURDO (AUSTRALIA) PTY LTD, PO Box 321, Clayton, Vic 3168. Agent for Birch-Stolec, UK. **Subminiature thumbwheel switches.** Only 0.312in wide, the switches are available with 10-way, decimal, or binary (1248 and 1242 codes) readouts. The switch snaps into a panel cutout from the front which obviates the need for accurate drilling and additional mounting components.

PHILIPS INDUSTRIES LTD has announced that the marketing of Pye Unicam instruments will be transferred from Astronics Australasia Pty Ltd, a subsidiary of Electronic Industries Ltd, to the Scientific and Industrial Equipment Division of Philips. The change will take place from July 1, 1972. Pye Unicam instruments include equipment for gas and liquid chromatography; atomic absorption; ultraviolet, infrared and visible light spectrophotometry; and automatic wet chemistry analysis.

MALLORY BATTERIES (A'SIA) PTY LTD, 3 Chilvers Road, Thornleigh, NSW 2120. **Blank cassette tapes.** Four blank cassettes have been introduced, intended for the audiophile, office dictating, youth, and broad consumer market. For the audiophile, Professional Duratape is a new "cobalt energised" tape capable of studio-quality recording and sound reproduction. The other tapes are: Executape for office dictating machines; Fliptape, moderately priced for the youth market; and Duratape for the broad consumer market. The latter has a built-in head cleaner that automatically cleans cassette recorders before recording or playback.

R. H. CUNNINGHAM PTY LTD has moved its head office to Cnr Dryburgh and Victoria Streets, North Melbourne, Vic 3051. The telephone number is 329 9633.

AMALGAMATED WIRELESS (A'SIA) LTD has opened a new Queensland office at 73 Jane Street, West End Brisbane, Qld 4101.

PETER G. BROUGHTON has moved to 99 Sussex Street (near King Street), Sydney, 2000. The telephone number is 29 3845. Mr. Broughton has specialised in the repair of transistor radios for many years.

AMPHENOL TYREE PTY LTD, 10-16 Charles Street, Redfern, NSW 2016, is a newly formed company which will manufacture and market, under licence, the complete Amphenol line of electrical and electronic components, including connectors, potentiometers, switches, keyboards, and cable assemblies. The company is 60% Australian-owned with the balance held by Bunker Ramo Corp, USA, of which Amphenol is its largest operating group. CEMA (Distributors) Pty Ltd has been appointed national distributor for Amphenol connectors throughout Australia. The telephone number of Amphenol Tyree Pty Ltd is (Sydney) 699 2392.

FAIRCHILD AUSTRALIA PTY LTD has moved its South Australian office to North Terrace House, Hackney, SA 5069. The telephone number is (Adelaide) 63 1435.

AUSTRALIAN GENERAL ELECTRIC PTY LTD has moved to 86-90 Bay Street, Ultimo, NSW 2007. The telephone number is (Sydney) 212 3711.

PLESSEY DUCON PTY LTD, Battery Systems Division, PO Box 2, Villawood, NSW 2163, will market Eagle-picher professional battery systems in Australia, New Zealand and throughout the Pacific and Far East regions. This follows an agreement with the Electronics Division of Eagle-Picher Inc, USA. Types covered by the agreement include: magnesium perchlorate, metal air, nickel zinc, organic electrolyte, silver cadmium, and all types of silver zinc, thermal, and water activated high-performance battery systems. A contract has been awarded by the Australian Department of Supply under which Plessey Ducon and Eagle-Picher will jointly undertake a feasibility study concerned with Australian production of silver-zinc batteries for defence applications.

ELECTRONIC EXPORTS has changed its address to 94 Elizabeth Street, Melbourne. The postal address is GPO Box 5402CC, Melbourne, 3001, and the telephone number is 30 4286. The company is interested in expanding its markets in the Pacific area, including Papua New Guinea, and is seeking further agencies. A new company, Modern Electronics, has been formed at the same address to sell to Australian clients, and also seeks agencies.

McMURDO (AUSTRALIA) PTY LTD, PO Box 321, Clayton, Vic 3168, has advised that the death occurred on February 19, 1972, of Mr Norman W. Swann, the founder and chairman of the company. Mr Swann also founded the Swann Electric Co in New Zealand.

Mr N. W. Swann

Mr L. F. White

AUSTRALIAN TELECOMMUNICATIONS DEVELOPMENT ASSOCIATION has appointed Mr L. F. White, MSc, FAIM, as its new chairman. He is managing director of Metal Manufactures Ltd, and has been a member and councillor of the association for many years.

A & R-SONAR ELECTRONICS GROUP (NSW) PTY LTD has moved to larger premises at 4 Close Street, Canterbury, NSW 2193. The telephone numbers are (Sydney) 78 0281-2-3.

BOOKS & LITERATURE

Guide for Dxers

SHORT WAVE LISTENING, by J. Vastenhoud. Published by NV Philips' Gloeilampenfabrieken, Eindhoven, The Netherlands, 1966. Soft covers, 5¾in x 8½in (145mm x 215mm), 107pp, many diagrams and tables. Price in Australia, $2.73.

Published as one of the Philips' paperback series, this book has been written by a leading short-wave expert who broadcasts regularly from Radio Nederland and conducts many of the courses for listeners conducted by that station. It is intended as a guide for regular listeners to short-wave stations and also for radio amateurs interested in the subject. The former group includes many migrants anxious to keep in touch with their homelandd.

There are 12 chapters, as follows: Short Waves; The Principles of Short Wave Transmission; Practical Short Wave Transmitting; Short Wave Prediction; Sources of Interference; The Aerial; The Correct Choice of Receiver; Communications Receivers; Regulations Governing the Use of Frequencies in the Short Wave Band; DX-ing in Practice) DX-ing with a Tape Recorder; DX-ing Using a Frequency Meter. There are also three appendices: Some Commonly Used DX Terms in Three Languages; Transmission of Time Signals at Standard Frequencies; Some of the More Important DX Clubs.

The chapters on transmission are, in fact concerned not with short-wave transmitters but rather with ionospheric propagation. There are three eternal prediction tables in the fourth chapter: these give the optimum working frequencies for working between 13 areas throughout the world and for high, medium and low sunspot counts. A design for a SW converter, with constructional hints, is given in the chapter on communications receivers. The ninth chapter discusses the international agreements governing the allocation of frequencies and tabulates the frequencies allocated to the various services, including broadcasting.

This is a valuable introduction to the subject for anhone interested in starting in this fascinating hobby. It is complete enough to answer most questions likely to be asked and, at the same time, simple enough for the non-technical reader. Experienced listeners will also find much of interest to them within its covers, in particular the prediction charts and the standard time transmissions. At its very low price, we must recommend this book to all DX-ers.

The review copy was supplied by Philips Industries Ltd, Sydney. Copies may be obtained from the Elcoma Division of Philips Industries in all states. (J.H.)

Frequency-time station

NBS TECHNICAL NOTE 611. Issued October, 1971. Published by the United States Department of Commerce for the National Bureau of Standards. Paper cover, 29 pages 10½in x 8in.

This booklet is sub-titled "NBS Frequency-Time Broadcast Station WWV, Fort Collins, Colorado", which gives a lead as to what it is all about. It is written by Peter P. Viezbicke and describes various aspects of Station WWV.

There are seven sections, the first being devoted to the reason for the publication, along with a brief history of WWV. In the second section, a short description of the transmitter site is given, along with rather detailed maps and a photograph of the area. The third section deals with building design for the transmitters and associated equipment. This includes a detailed floor plan and three photographs.

Section four is somewhat more technical and is divided into four parts. These parts are sub-titled Antenna Design, Frequency-Time Code and Control Systems, Transmitters, and Monitoring System. Once again, the various items are well illustrated with diagrams and photographs.

Sections five, six and seven, include a Summary, Acknowledgments and References, respectively.

Any person interested in time and frequency, particularly with regard to WWV, would be more than interested in this publication. It should have an appeal and interest for both radio amateur and professional alike. Being interested in this subject myself, I found the reading both interesting and enlightening.

This booklet is available and I quote "For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. (Order by Catalog No. C13.:611), Price 35 cents". It would be advisable to include an extra remittance to cover postage. (I.L.P.)

TV servicing

COLOUR TELEVISION SERVICING, by Gordon J. King. Published by Newnes-Butterworths, an imprint of the Butterworth Group, London, 1971. Hard covers, 6½in x 10in (163 x 255mm), 320pp, many illustrations. Price in Australia $14.35.

TELEVISION SERVICING HANDBOOK, 3rd Edition, by Gordon J. King. Published by Newnes-Butterworths, an imprint of the Butterworth Group, London, 1970. Hard covers, 6½in x 10in (163 x 255mm), 357pp, many illustrations. Price in Australia $12.70.

With colour TV now definitely on the horizon for Australia, no doubt many service technicians will be giving serious thought to acquiring the knowledge necessary to adjust and repair colour equipment. And although there is no real substitute for the practical experience gained by actually adjusting a colour receiver or monitor, much useful background knowledge can be gained from suitable books.

These volumes by well-known British technical writer Gordon King are well worth consideration by the technician with this in mind. Although they are written specifically for the service technician working in the UK, they provide much information which would be equally suitable for Australian conditions. This is especially true of Colour Television Servicing, partly because it refers less to specific British equipment, and partly because the British colour TV standards are very close to those which will be used here.

As its title suggests, Television Servicing Handbook is the more basic volume. Its contents and their presentation are shown fairly well by the chapter headings: 1 — Introduction; 2 — No Sound, Vision or Raster; 3 — No Raster, Normal Sound; 4 — No Sound or Vision, Raster Normal; 5 — No Vision, Sound and Raster Normal; 6 — Fault Tracing in the Sound Channel; 7 — Servicing the Timebases; 8 — Synchronising Faults; 9 — Vision AGC Systems; 10 — Picture Tube Faults; 11 — Receiver Alignment; 12 — Miscellaneous Faults; 13 — Colour Television; 14 —

Television in the UHF Bands; 15 — Dual Standard and 625-line only Receivers; 16 — Transistor Television Receivers.

Colour Television Servicing is really a complementary volume to the other, starting up where its companion leaves off. The chapters are headed: 1 — Introduction; 2 — The Science of Colours; 3 — The Colour Camera, Signals and Displays; 4 — The Shadowmask Picture Tube; 5 — An Overall View of the Colour System; 6 — Purity and Convergence; 7 — Timebases, EHT and Power Supplies; 8 — Luminance, Colour Difference Amplifiers and Grey-Scale Tracking; 9 — Vision, Chroma, Reference Generator and Sound Stages; 10 — Encoding and Decoding; 11 — Test Instruments and Signals; 12 — Locating the Fault Area; 13 — Servicing Procedures; 14 — Servicing in the Field; 15 — Tuned Circuit Alignment; 16 — Faulty Picture Tube Symptoms.

Both books are written in clear language and should be easily understood by most service technicians and interested amateurs. They would appear to give reasonably good coverage of the subjects concerned, although both are a little less practical in orientation than I would have liked. The more basic book could well give a more thorough treatment of solid-state circuitry, particularly with respect to ICs. I think it would also benefit considerably by the addition of a chapter dealing with general practical techniques such as the use of tools and test instruments, isolating faults, and detection of intermittents.

Colour Television Servicing is somewhat more satisfying than its companion, but even here it would have been nice to see a chapter or section dealing with colour tubes other than the RCA shadow-mask type. But these are perhaps rather academic criticisms. Both books are well written, and certainly deserve consideration by the technician intending to prepare himself for "C-day".

The review copies came from Butterworth and Co (Aust) Ltd, but copies should be available at all major bookstores. (J.R.)

LITERATURE—in brief

VARISCOPE, Vol 2, No 1, 1972. Published by the Electron Tube and Device Group, Varian Pty Ltd, 82 Christie Street, St Leonards, NSW 2065. Contents: The microwave tube industry; Microwave filters from Varian; Five watt, 50-80GHz extended interaction klystrons; More from the Varian range of CTC transistors.

STANDARD TELEPHONES & CABLES PTY LTD, Components Division, Moorebank Avenue, Liverpool, NSW 2170, has published new data sheets for the following components: thin film video amplifier 131BCR; thin film circuits; unijunction transistors 2N2646 and 2N2647; triac TC1101; triacs TC1102 and TC1103; low current thyristors TS1201 to TS1205; diac V413; silicon capacitance diodes; medium current silicon rectifiers 1N4719 to N4725, 1N4997 to 1N5003; thermistors NTC and PTC.

R. H. CUNNINGHAM PTY LTD, GPO Box 4533, Melbourne, Vic 3001. Technical Library Service Bulletin, February 1972. Gives brief technical details of the following products: Sennheiser headphones with boom mikes; Geloso sound lamps; Bulgin switched indicators; Geloso microphone boom and loud hailer; Jeanrenaud push button switches; Geloso portable PA sound system.

MICRONEWS, January 1972. The newsletter of Fairchild Australia Pty Ltd, 420 Mount Dandenong Road, Croydon, Vic 3136. Gives brief details of the following products: High speed MSI units, types 93H00 and 93H72; Scholtky TTL products, 9S series; Transistor and diode arrays; 8-bit addressable latch, type TTuL MSI 9334.

AMATEUR BAND NEWS AND NOTES

by Pierce Healy, VK2APQ

New Structure for the IARU

What is the future role of the International Amateur Radio Union in maintaining the present status of amateur radio, or strengthening its image in the eyes of officialdom and the general public?

This question has been asked by many amateurs who are seriously concerned with the future of amateur radio. A step that appears to be in the right direction was taken at the recent American Radio Relay League Board meeting.

Mention has been from time to time in these notes of the IARU. In recent months the efforts of the IARU team at the 1971 International Telecommunication Union conference were reported. These indicated the important part the team played towards maintaining amateur frequency allocations and the recognition of the Amateur Satellite Service.

While the vast majority of amateurs may not appreciate the importance of the IARU, the part the IARU should play has been the concern of a number of Australian amateurs for several years. Even in 1959 when briefing the late John Moyle, VK2JU, as the WIA observer to the 1959 ITU conference, Federal Council instructed John to discuss with other amateur representatives ways of invigorating the work of the IARU for the advancement of amateur radio.

The International Amateur Radio Union was founded in 1925 and in 1928 was reconstituted to become a liaison of national amateur radio societies throughout the world. With this change the constitution was amended to provide that one national society act as the headquarters, and that the officers of this society should hold similar positions in the IARU. The ARRL was chosen as the headquarters society. Since then its presidents have automatically become president of the IARU and its work carried out by the ARRL secretarial staff.

In 1950 the Region I Division was formed, sponsored by the RSGB, to provide representation of the European and African societies. This was followed by the Region II Division to represent the Americas, and, in 1968, the Region III Division, sponsored by the WIA, to represent societies in Asia and Oceania. All this has greatly increased the work load on the IARU officers.

The IARU constitution does not require member societies (86 at present) to contribute financially. The organisation has always been financed from ARRL funds. It should be pointed out, however, that the ARRL is the largest amateur radio organisation in the world (membership in excess of 100,000) and therefore is the only society in the IARU capable of meeting the administration costs.

The present set-up has been the subject of some discussion, particularly among European societies. Some consider that the officers should be dissociated from the administrative duties of the headquarters society. Others favour a body separate from any national society, while some suggest that it should represent the three regional organisations which, in turn, represent the national societies in their regions.

From the report published in "QST" March 1972, it is apparent that the future role of the IARU as the international representative of amateurs has been considered very closely in ARRL circles.

"At the ARRL Board meeting in January, where officer elections were on the agenda, there was considerable discussion about the growing demands on the personal time of the individual holding the joint office of IARU ARRL president, and what might be done to ease the burden — yet still protect and advance the best interest of both organisations. President Bob Denniston, WODX expressed the view that the dual responsibilities have grown beyond the reasonable capabilities of one man, particularly an unsalaried volunteer, and that as indicated by the Geneva Space Conference as an example, they will be even more demanding in the future.

"Accordingly, he announced he would not be a candidate for re-election as ARRL president. At the same time he called attention to a section of the IARU Constitution which provides that a national officer of the member society chosen as IARU Headquarters has the option of declining to serve in a similar capacity for the Union, whereupon said member society is obliged to nominate another qualified and responsible official of its society for the post. Bob indicated he would be willing to stand as candidate for the presidency of the IARU under these provisions if that were a suitable solution. The Board of Directors was much impressed with this philosophy and later elected him as vice-president of ARRL.

"Harry J. Dannals, W2TUK, was chosen as the new ARRL president. He promptly stated to the Board his similar belief that the offices of president of both organisations are each so important and so demanding of time and energy that they should be held by separate individuals. He thereupon chose not to accept the parallel IARU office, and immediately nominated Bob Denniston, WODX as the ARRL official recommended for the post of IARU president — a motion which was unaminously adopted.

"This does not entirely firm up the matter; the real decision must come from the 86 member-societies of IARU — a voting procedure now under way. We feel reasonably certain, however, that foreign society officers will quickly appreciate the problem, from their own participation in IARU activities, and we hope for their approval of the proposed solution. The nominee is, we believe, ideal for the post; these past six years, in particular, he has devoted immense energy to the advancement of IARU. The Union's growth, both in numbers and effectiveness is the best argument for support of the Boards course of action."

In the ITU, the IARU is recognised as the official body representing the Amateur Service. But the IARU has only observer status and no voting privileges. This places the IARU in the position of being dependent on whatever influence can be exerted on national delegations to vote in favour of amateur service proposals and to reject attempts to curtail amateur frequency allocations.

Therefore it would appear that a future role of the IARU will be to assist national amateur radio societies to present a uniform approach to their national administrations on matters which affect the Amateur Service as a whole. Also it should ensure that full information on its activities is passed to members, keeping them informed of international trends in policy.

By the same token it will be the responsibility of national societies to actively support the IARU by keeping their members acquainted with international events which have an effect on amateur radio.

ARRL NEWS

As indicated elsewhere, the ARRL elected Harry J. Dannals as their new president at the Board of Directors meeting on January 20-21 1972

The proceedings of the meeting recorded in the March 1972 "QST" provided interesting reading and gives an insight into the size and strength of the ARRL.

A motion adopted that caught the eye was the decision to petition the Federal Communications Commission to permit licensed amateurs, 18 years and older, to conduct licence examinations. Another was "that a study be made by the Headquarters staff for all possibilities for procuring hard-to-get components necessary in the building of specific construction articles as printed in QST or the handbook."

In the March issue of these notes mention was made of a proposal made to NASA for the installation of an amateur 10 metre transceiver aboard the SKYLAB manned orbiting laboratory. Unfortunately, this proposal has been turned down but, from a report in QST, only after the most careful consideration on the part of NASA.

WIRELESS INSTITUTE ACTIVITIES

Following the incorporation of the federal body of the Wireless Institute of Australia in January 1972, the March issue of the magazine "Amateur Radio" was the first to be published under the direct control of the Federal Executive. The magazine for many years has been published by the Victorian Division, WIA. The change brings the magazine under the control of the Federal Council which represents all institute divisions. Due to the rise in postal charges and other expenses affecting divisional finances, discussions have been taking place regarding the way in which news relating to individual divisions can be included. This is necessary in order that members will receive the same service as that previously given through division bulletins.

Following the incorporation of the new company, known as the Wireless Institute of Australia, the following will hold office:—

President and Chairman	Michael Owen	VK3KI
Vice-chairman	David Rankin	VK3QV
Editor	Bill Roper	VK3ARZ
also	David Wardlaw	VK3ADW
	Bill Faul	VK3AGZ
	James Goding	VK3DM

Peter Dodd, VK3CIF was appointed secretary.

These appointments were to stand until the federal convention in Melbourne at Easter when the officers for the ensuing year were to be appointed by the Federal Council. (These notes were prepared prior to the Easter convention).

NEW SOUTH WALES

The Annual General Meeting of the NSW Division, WIA, was held at WIA Centre, 14 Atchison Street, Crows Nest, on Friday evening 24th March 1972. Business included the presentation and acceptance of reports from the president and treasurer; the Hunter Branch, and various clubs and officers. In his report the president expressed appreciation of the work done for the NSW Division by members of council and various committees. Due to the auditor's report not being completed the president indicated that the meeting would be adjourned, on completion of business on hand, until a date to be set.

Only seven nominations for council were received and as this number did not exceed the number required no ballot was necessary. The nominees were:— Mike Farrell, VK2AM; Bill Lewis, VK2YB; Tony Mulcahy, VK2ACV; Chris Jones, VK2ZDD; Grahame Wilson, VK2ZGW; Ian Mackenzie, VK2ZIM and Ian Binnie, VK2ZIU. At a brief meeting of the new council, held later in the evening, Tony Mulcahy, VK2ACV was elected president for a second term.

It was announced that the "Adams Trophy", presented to a NSW Division member for the best article in the magazine "Amateur Radio" had been awarded to Dr Bob Black, VK2QZ.

In accordance with a notice of motion given by the council at a previous meeting and unanimously adopted by members attending the annual general meeting, Honorary Life Membership of the institute was bestowed on two members, "For services given to the New South Wales Division, the Wireless Institute of Australia and amateur radio". Several members when speaking in support of the motion spoke very highly of the work done by the nominees, Cec Bardwell, VK2IR and Pierce Healy, VK2APQ.

In a resume of service by both members, the president, Tony Mulcahy, VK2ACV said — Cec Bardwell had been the division's AOCP class instructor and

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown, NSW 2200.

correspondence course supervisor since 1962. During which time he had re-written and brought up to date the class and course notes. In addition he had organised the printing and collating of the notes into book form at a considerable saving to the institute.

While more than 150 students had completed the lecture classes up to the present, it was not possible to accurately assess the number throughout Australia and overseas countries, who had reached AOCP standard through the correspondence course.

Referring to his dedication as a teacher, it was recorded that Cec had not missed a class since he had taken the position as class instructor. This efficient operation of both the class and correspondence course has meant a continuing source of income to the NSW division.

In addition to his work associated with amateur radio and the WIA Cec has for more than 35 years served the community in the field of radio communication by training professional radio operators and technicians at the Marconi School of Wireless.

Highlights recounted of the service given by Pierce Healy were:—

1955-1956 Chairman VHF Group
1956-1957 Vice-chairman VHF Group
1957-1958 Chairman VHF & TV Group
1958-1960 President NSW Division WIA
1961-1971 Federal Councillor NSW Division WIA
1971-1972 Councillor NSW Division WIA

During the period 1955-1972 had been:—

Chairman of the "Ad Hoc" committee which reviewed the constitution of the NSW Division WIA in 1958.

Member of the Divisional Constitutional Committee dealing with the new WIA Federal constitution — 1964-1969.

Chairman of the organising committee for the IARU Region III Inaugural Congress held in Sydney 1968.

Member of the Novice Licensing Investigation Committee 1970-1972.

Representative of the NSW Division at 12 federal conventions, travelling to all States in the Commonwealth.

Closely associated with the YRCS since its inception.

Closely associated with the Australis-OSCAR V satellite project group.

The initiator of federal policy motions that committed the WIA to adopt the YRCS as an institute activity on an Australia wide basis, also, to support the Australis satellite project group and to initiate the formation of the Region III Association.

Both members expressed their deep appreciation of the honour bestowed on them and their willingness to continue to work for the benefit of the WIA and amateur radio.

Life membership certificates and distinctive membership badges were presented to them to mark the occasion.

VHF & TV Group

The VHF & TV Group, NSW Division, publishes a monthly newsletter giving information on local activities, plus items of interest gleaned from various sources. Technical articles of interest to the VHF experimenter are also included.

The March 1972 issue contained some interesting data on "Tropospheric-DUCT Communication" and the IPS (Ionospheric Prediction Service) warning system.

Under the revised VHF & TV Group constitution the election of the management committee will be by ballot from nominations received 21 days prior to the annual meeting and not from nominations called for at the meeting as has been the practice in the past. The annual meeting for 1972 was set down for Friday April 9th.

Copies of the VHF & TV Group Newsletter may be obtained by writing for details to the Secretary VHF and TV Group, 14 Atchison Street, Crows Nest, NSW 2065.

Meetings are held on the first Friday of each month at Wireless Institute Centre, 14 Atchison Street, Crows Nest, commencing at 8.00 pm. Visitors are welcome.

VICTORIA

Geelong Amateur Radio — TV Club

The Geelong Ham Fest organised by the Geelong Radio and TV Club will be held on the weekend 13th-14th May 1972. An interesting program has been drawn up and visitors are invited to attend.

Club members who participated in the John Moyle Memorial National Field Day on 12th and 13th February 1972 voted the project an outstanding success. Stations were operated in the 3.5MHz; 7.0MHz, 14.0MHz, 21.0MHz, 52.0MHz and 144.0MHz bands. Despite the collapse of a tent and the loss of a log sheet during a high wind, the group finished with a creditable score of 3,338 points.

Details of the club's activities may be obtained from the Secretary, Geelong Amateur Radio — TV Club, PO Box 520 Geelong, Victoria 3220.

Amateur Satellites

Information from several unofficial sources indicates that launching of the Amateur Service satellite AO-B will be delayed until mid-1973, not 1972 as originally planned. In its place, AO-C will be launched in July 1972. This will carry the AMSAT 144MHz 28MHz repeater and not the Australis 144MHz 432MHz and the German 432MHz 144MHz as originally planned.

The reason for the change is believed to be due partly to a reduction in weight allowable on the NASA launch vehicle. The AMSAT repeater will be a multiple access linear system accepting signals on the up link between 145.9MHz and 146.0MHz and retransmitting them between 29.450MHz and 29.550MHz.

A beacon on 29.45MHz and a Morse telemetry system will also be aboard AO-C. There will also be a command system to control the various satellite systems. SSB or CW is recommended as the mode for best results.

In the editorial of the NSW VHF & TV Group Newsletter, for March Mike Farrell, VK2AM comments as follows:—

"Fortunately the problem arising from the satellite repeater clash in frequency will not be as acute as with the Australis FM system. The AMSAT translator is 100KHz wide, centred on 145.9MHz and should enable a local SSB station to work through the translator and still be 50KHz away from the Channel 4 output frequency.

"The use of SSB or CW adjacent to Channel 4 will not unduly affect Channel 4 reception with a modern FM receiver, but problems may arise with older, broad IF type units. I hope that repeater users in this category do not indulge in anti-social behaviour when they experience interference from AO-C operators. The user will have to bear in mind that the fault lies in his ancient type unit and that the AO-C operator can just as easily time-out the local repeater during satellite passes. This can only result in ill feeling and chaos, so persons who are likely to find themselves in this situation should start preparing (technically) for the advent of AO-C immediately."

Amateur Television

Two items of interest relating to amateur TV were gleaned from the "Victorian VHFER", the publication of the VHF Group, Victorian Division WIA.

First was that Mac McKibbin, VK3YEO, of East Doncaster, Melbourne, received slow scan TV pictures from John Van Staveren, VK7JV in Launceston on Tuesday 8th February 1972. This was no doubt the first interstate SSTV DX on the 144MHz band. Unfortunately John had not finished his monitor and could not receive pictures from Mac and so make it a two-way contact.

Second, ATV was given a big boost with the reception in Melbourne of pictures from Winston Nickols, VK7EM in Penguin, Tasmania. Winston's 426.25MHz signals were received by W. Biggs, VK3ZBZ at Chadstone, Peter Wolfenden, VK3ZPA in Sunbury and G. Brown, VK3YGB at Essendon. Peter VK3ZPA received noise free pictures and could read valve markings when Winston turned his camera on his 432MHz transmitter. This would certainly be the longest one way ATV contact in Australia, about 240 miles. The previous record for a two-way was 93 miles, established in South Australia. Peter VK3ZPA is set up to transmit ATV but a two-way contact could not be achieved as Winston, VK7EM had not completed a converter.

The "Victorian VHFER" is edited by Bob Halligan, VK3AOT and gives a wealth of information on various VHF topics.

In the March 1972 issue the following VHF UHF contacts were recorded:—

144MHz:
7th February VK6VE beacon heard in Geelong
8th February VK5ZK Adelaide to VK6BE Albany
9th February VK6VE beacon heard in Melbourne
13th February VK3ZUR Tullamarine and VK3YCD P3 to VK1VP P1 ACT.
22nd February VK3AKC Geelong to VK5DY Adelaide.
25th February VK7EM Penguin Tasmania to VK5ZTH Mt Gambia.

432MHz:
8th February VK5ZK Adelaide on CW heard by VK6-BE Albany.
24th, 25th and 26th February several contacts between Melbourne and northern Tasmania.

1296MHz:
26th February VK3AKC Geelong to VK7ZAH Launceston a distance of 274 miles.

WIA YOUTH RADIO SCHEME

The Federal Supervisor of the WIA Youth Radio Club Scheme, Reverend Bob Guthberlet, has requested the NSW YRCS Division to be hosts for the YRCS conference in May 1972. Plans will be formulated for future growth as well as a degree of standardisation in various aspects of the scheme.

South Australia

A review of the YRCS activity in South Australia during 1971 shows that the number of certificates gained by members of registered clubs were:—

Elementary Certificate	30
Junior Certificate	9
Intermediate	1

There were 156 club members in South Australia.

A total of eleven clubs were registered.

Those gaining points for the IREE Pennant Award were:—

School Clubs: Naracoorte High School	215 points
Non School Clubs:	
Port Pirie Youth Radio Club	490 points
Elizabeth Youth Radio Club	356 points
Barossa Valley Radio Club	281 points
St Mary's Boy Scouts Club	185 points
Woomera Youth Radio Club	140 points
Port Augusta Youth Radio Club	125 points

The club member most successful at YRCS examinations during 1971 was Jeffrey Hunt of Elizabeth Youth Radio Club.

So far eight clubs have registered in 1972. Enquiries have been received from a number of secondary schools and colleges and it is expected that registrations will be increased. All clubs who register with the YRCS receive an address list of the other clubs giving times of meetings, club call sign, if any, and the approximate number of members. Clubs are able to arrange combined visits to a radio or TV station, plan an inter-club visit, or "on the air" contacts. Such activities have been successfull in the past.

The following members of the Prince Alfred College Radio Club have gained their YRCS Elementary Certificates:

Honours Pass — Anthony Morcombe

Credit Pass — Neil Walker; Richard Lister; Mark Vogt; Peter Lachlan; Mark Spooner.

Pass — John Swanson; James Baker; Mark Ramsey.

Westlakes Radio Club

The annual general meeting of the Westlakes Radio Club was held on Wednesday evening 23rd February 1972. Kev Watson, president of the Maitland Radio Club chaired the meeting. The following officers were elected for the coming year.

Director: Keith Howard VK2AKX
Co-director: Joe Waugh VK2IQ
Secretary: Eric Brockbank VK2ZOP
Treasurer: Max McLachlan —
Store Manager: Ray McCook —
Canteen Manager: Daryl Boyce —

Committee:

Wal Lean	VK2ZZK
Stan Lloyd	VK2AYL
Arthur Day	VK2BBI
Herb Herivel	VK2ZVF
Chris Minahan	VK2ZUZ
Norman Judd	—
Geoff Taylor	—

Equipment Officer: Herb Herivel VK2ZVF

In his report the Director Keith Howard said that ten members of the club had gained either the AOCP or AOLCP during the year as well as an encouraging number of YRCS certificates.

Maitland Radio Club

Kev Watson, VK2BLW president of the Maitland Radio Club said in his annual report that the prestige of the club had continued to grow during the past year. Club membership had reached 137 and total attendance at all club activities had totalled 3,513.

The Deputy Mayor of Maitland, Alderman N. V. Unicomb conducted the election of officers at the annual meeting held in the club theatrette on Friday evening 10th March 1972. Kev Watson, the club's inaugural president and life member was re-elected unopposed.

Other officers are:—

Patrons; Sir Allen Fairhall; Dr R. H. K. McKerihan
Vice-president: D. Cross
Secretary-treasurer: Mrs M. Watson
Assistant secretary Mrs J. Watson
Committee: B. Thompson, A. Watson, J. Gibson, K. Mahon, J. Whitehead, Mrs N. Whitehead, L. Morris, W. Vassella, junior representative; Phillip Ellicott.
Auditor: A. Matthews.
Solicitor: Thompson Norrie and Company.
Trustees: Ald. N. V. Unicomb, C. G. Cooke, W. Plant.
Grounds officer: J. Whitehead, Assistant R. Digby.
Examinations officer: C. G. Cooke.
Canteen Manageress: Miss H. Eswick.
Canteen officers: P. Ellicott, A. Killkelly.
Librarian: L. Morris.
QSL officer: W. Plant.
Publicity: K. Watson and A. Watson.

The club's exhibit at the Maitland Show was an outstanding success.

A panel of eleven judges awarded the 2HD shield to K. Gormley for his home built signal tracer. Donors of other prizes for home built equipment displayed by members were: The Maitland Mercury, Jayes Travel Service, Ells Book Store, Cappers Pty Ltd., Royal Newcastle Aero Club, Waltons Camera Department and Electronics Australia.

29 DX Club Project

The 29 DX Club of Perth W.A. have been offered the use of a mast by TVW Channel 7 for special DX tests on 40, 80, and 160 metres. It is intended to set up a portable station on that site on the nights of 27th May and 3rd June, 1972. The station call will be VK6HD P.

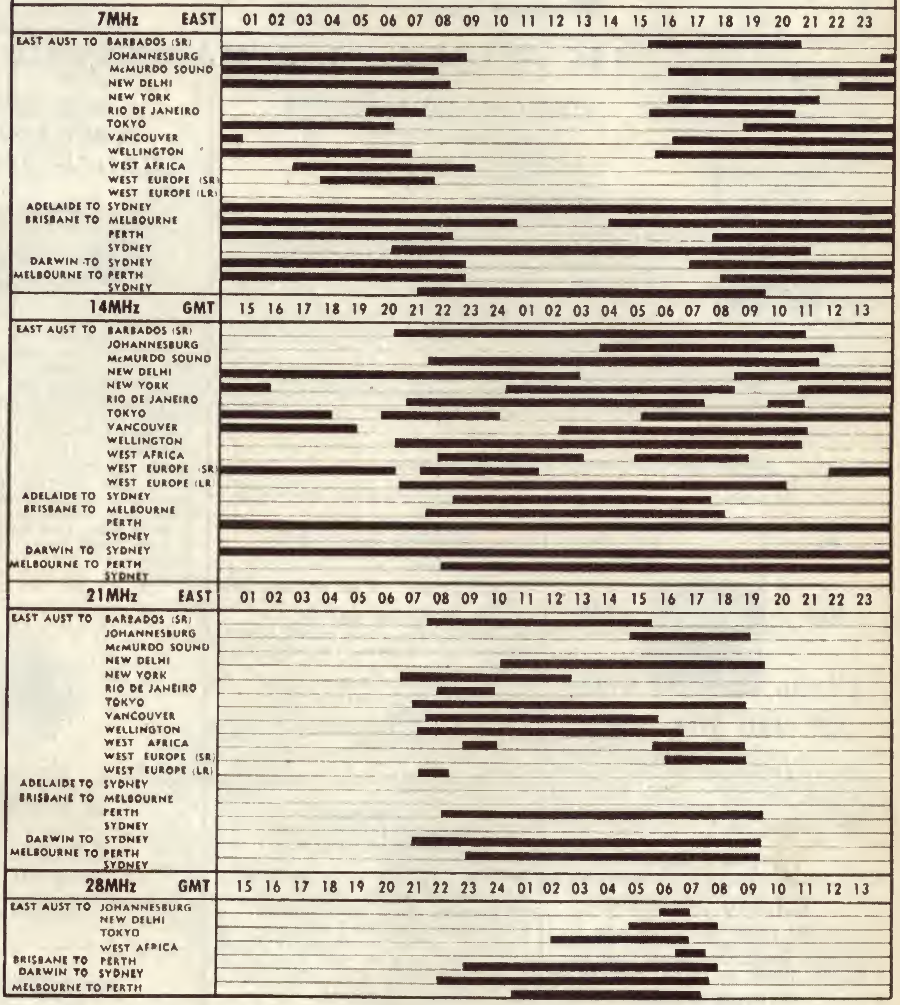
The first weekend of operation will be from 1600GMT 27th May to 0200GMT 28th May. VK6HD P will be on 7005KHz between these times, with the exception of 2130GMT to 2330GMT, when the station will transmit on 1803KHz. The object is to make contact with amateurs in Europe and the Americas.

The second weekend will be from 1600GMT 3rd June to 0200GMT 4th June. Throughout that period VK6HD P will transmit on either 7005KHz or 3512KHz, plus or minus QRM. The main objective will be to contact portable stations in England during the RSGB National Field Day Contest.

On both weekends inverted "V" antennas will be used with a minimum height of 375ft (123 metres) to the apex, and an input of 150W CW.

IONOSPHERIC PREDICTIONS FOR MAY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Commonwealth Bureau of Meteorology. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). They have been prepared for the four most popular amateur bands over a number of interstate and international circuits. Black bands indicate periods when circuit is open. 5.72



LISTENING AROUND THE WORLD

by Arthur Cushen, MBE

Good reporting leads to improved reception

Short-wave listeners can assist in improving reception by keeping stations informed on frequency changes and interference which affects their transmission.

Four times a year the International short-wave stations make their major frequency changes, on the first Sunday in March, May, September and November, because of seasonal changes, and also to try to decrease interference. Recently in Radio Nederlands DX Jukebox program the reasons for these changes were fully explained.

Short-wave stations are supposed to operate within the internationally allocated short-wave bands. While stations which are members of the ITU (International Telecommunication Union) submit their provisional broadcasting schedules to a central office of the ITU in Geneva, Switzerland, others do not.

In Geneva, ITU and IFRB (International Radio Frequency Bureau) sort out the schedules well before they are due to come into operation.

The material submitted to Geneva by broadcasters covers the four periods of transmission each year, two of which are for two months, the other two for four months. The two-month periods are at the time when the sun crosses the equator and unstable conditions prevail; the four-month periods cover summer and winter, when the seasonal conditions are relatively constant.

If there were ample room for short-wave stations in the bands and mutual interference was rare, no additional changes would be necessary during these periods because each station is allowed to work two frequencies in different bands for each program, in order to cope with ionospheric irregularities. However, if interference from another station is suffered measures have to be taken.

Firstly, the effect of the interference has to be estimated or measured; secondly the search for a new channel with better reception possibilities in the target area has to be conducted. This is often a difficult matter, as in most cases the transmitting station is unable to judge the band conditions in another part of the world. Here is where the help of well-equipped listeners and monitors comes in.

Then a decision has to be made, whether to move to another part of the band, or to stay put? During the periods between seasonal changeovers, stations prefer not to move about too much because moves to unlisted frequencies can be confusing to listeners. Moreover some stations may have a long standing use of certain frequencies originating from the early days of short-wave broadcasting, when there was ample room on the bands and co-ordination and planning were not necessary. It may be possible to persuade interfering stations to move, but in practice it is the weaker station which usually does so. Then the IFRB has to be notified of the change so it can be included in the frequency schedule.

It can be therefore seen that the short-wave listener can play a vital part in improving reception for the better enjoyment of listening as a whole. In our own case we are continually providing recordings, cabling details and reports on interference problems to many of the world's leading stations, so that our readers can better enjoy their short-wave listening.

In our monitoring work we have supplied information to the BBC since 1942 by cable and airmail reports, to the CBC since 1945 and to the Voice of America, all on a weekly basis. On a monthly basis Austria, Holland, South Africa, Sweden, Vatican and other stations receive reports of monitoring over a monthly period.

TESTS FROM BONAIRE

Radio Nederland relay station on Bonaire has been using 9715 and 11730kHz for its services to Australia and New Zealand. Both channels are on the air 0630-0750 when 9715kHz has Dutch and 11730kHz has English, and again 0800-0920, when 9715 has English and 11730 has Dutch.

In recent months, 11785 has been used for the 0800-0920 Dutch transmission, but this was not a success because of the crowded nature of this part of the band. Radio Nederland recently conducted tests on 9770kHz in an effort to find an alternative channel for this transmission. The frequency of 11730kHz was also tried, but did not provide satisfactory reception in Australia because of adjacent channel interference. Radio Nederland may now decide to use 9770kHz for the 0800-0920 Dutch transmission to Australia.

FINLAND USING 13M

Finland is testing in the 13-metre band with a 1kW transmitter. These tests are being carried out in addition to their normal short-wave service. The transmission is to the following schedule:

GMT		kHz
0600-0630	(weekdays)	21605
0630-0650	(Sundays)	21605
1000-1115	(weekdays)	21595
1200-1315	(weekdays)	21595
1500-1830	(weekdays)	21605
1430-1830	(Sundays)	21605

RADIO OMDURMAN

A verification letter received by Chris Davies of Featherston, NZ, lists the frequencies and power of Radio Omdurman as well as its present schedule:

kHz	kW
764	100
960	60
4994	20
6150	20
7200	120
9505	50
11835	120

The station also has the use of the following alternative frequencies:

572	50
15170	50

Broadcasts in Arabic are 0400-0800 and 1100-2200 on 960, 764, 4994, 6150, 7200, 9505, and 11835kHz. A special program to Southern Sudan broadcast 1600-1900GMT on 4994 and 11835kHz includes programs in Arabic and English.

NEPAL VERIFIES

Radio Nepal at Kathmandu has confirmed our reception on 5000KHz with an airmail letter and card. The station was heard on a Saturday at 1400GMT, but suffered interference from WWV and WWVH.

The latest Radio Nepal schedule shows that they operate MW on 790KHz and SW on 5000KHz, 0120-0350, 0720-0950 and 1150-1550GMT.

The verification card is signed by Mr K. B. Khatry, Chief Engineer. The address is Ministry of Communications, Department of Broadcasting, Radio Nepal, Singha Durbar, Kathmandu Nepal.

AFRTVS SCHEDULE

The American Armed Forces Radio and Television Service which originates radio programs from studios in Washington and broadcasts them over the transmitters of the Voice of America, is well received in the South Pacific. The programs include news on the hour and half hour, as well as interesting discussion and sporting features. The AFRTVS schedule is:

MT	KHz	Ca 11
1330-2300	15430	GA9
1330-2100	2150	BY1
2100-2300	15330	BY1
1330-1745	15430	GA5
1745-2300	11790	GA5
1200-0400	15330	BY3
0200-1200	9755	BY5
2130-0200	21500	DL5
2130-0400	17765	DL4
0200-0500	15410	DL7
0400-0700	11805	DL8
0500-1630	9700	DL5
0700-1500	6100	DL6
1400-1630	11805	DL4

The transmitter locations are as follows: DL Delano, California; BY Bethany; GA Edward R. Murrow Transmitter Site, Greenville, North Carolina.

BANGLADESH SCHEDULE

Additional information on Radio Bangladesh has come from Alok Das Gupta of Calcutta, India, who gives the schedule as follows:

GMT	kHz
0030-0300	4875
0030-0230	7095
0600-0830	9425, 7240, 15520
1100-1600	15520
1100-1300	5985
1245-1430	9855
1530-1600	9855
1315-1600	4875

NEW SERVICES FROM DEHLI

All India Radio at Delhi has introduced a program in Russian, and has also extended its French broadcasts in its overseas services. An item in Sweden Calling DXers lists the Russian transmission as 1615-1715 on 7110 and 9615kHz, with news at 1630GMT. All India Radio also broadcasts in French to South Asia 1115-1130GMT on 17705 and 21660KHz and to Europe 1845-1930 on 3905 and 9912KHz.

VOICE OF HOPE TESTS

The Voice of Hope has advised that tests are being carried out on 9670KHz over the facilities of Trans World Radio at Sines in Portugal. This frequency is in use on Sunday from 0645GMT. Reception has been best on Sunday at 0800GMT with a program in English. The full test schedule is as follows:

GMT	Day	Area
0645	Sunday	Greece
0700	Sunday	North Africa
0715	Sunday	Central Europe
0730	Sunday	Germany
1200	Sunday	Italy
2100	Monday	France
2100	Tuesday	Germany
1300	Thursday	Greece
1200	Friday	Italy
2100	Friday	France

Broadcast Band News

JAPAN: Several Japanese stations which carry commercial programs have increased power. The latest of these is JOBR at Kyoto on 1140kHz, which now has 20KW. Others are JOKR, 950kHz, Tokyo; JOQR, 1130kHz, Tokyo; JOLF, 1240kHz, Tokyo (all 100kW). Stations using 50KW are JOHR, 1290kHz, Sapporo; JOWF, 1440kHz, Sapporo; JOAR, 1050kHz, Nogoya; JOSF, 1330kHz, Nagoya; JONR, 1010kHz, Osaka; JOOR, 1210kHz, Osaka; JOUF, 1310kHz, Osaka. JORF, 1420kHz, Yokohama, has increased power to 30kW, and JOBR, 1140kHz, Kyoto, to 20kW.

FRANCE: According to "World Bulletin", the transmitter at Selestat on 1277kHz increased power from 100kW to 300kW last month.

ISRAEL: "Sweden Calling DXers" says that Radio Eilat is a new station operating at Eilat in the south of Israel. Radio Eilat is the only private station in Israel, and broadcasts popular music and underground music 24 hours a day on medium wave 1430kHz.

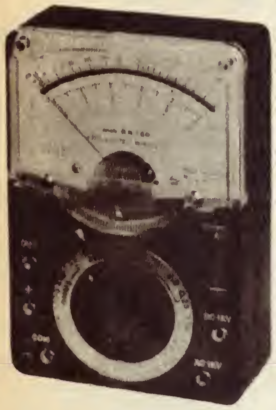
According to "World Bulletin", the Israel Home Service D program, currently observed with news in English at 1830 followed by French at 1845GMT on medium-wave 732kHz, a slight move from 737kHz.

BANGLADESH: A report from Alok Das Gupta, Calcutta, informs us that all transmitters of Radio Bangladesh at Khulna are now back on the air. The station was destroyed in the December fighting. The last transmitter to become operational is on 1340kHz, and operates with 1kW 0030-0300 and 1100-1600GMT.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, New Zealand. All times are GMT. Add 8 hours for WAST, 10 hours for EAST, and 12 hours for NZ.

NEW RH (Radio House) RANGE OF MULTIMETERS

MODEL RH-60 $29.00 Packing & Postage $1.00



50,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.
Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 25uA, 5mA, 50mA, 500mA.
Resistance: 10K, 100K, 1M, 10M.
Decibels: —10 +62dB.
Accuracy: DC ±3 p.c., AC ±4 p.c. (of full scale).
Batteries: Two 1.5V dry cells. Overload protected.

MODEL RH-100 $39.75. Postage $1.00

100,000 Ohms per Volt DC 10,000 Ohms per Volt AC

• Overload protected by dual silicon diodes • Double-jewelled ± 2 per cent meter • ± 1 per cent temperature-stabilised film resistors • Polarity changeover switch • Mirror scale • Instructions for operation with circuit diagram.

SPECIFICATIONS:
DC Volts: 0.6, 3, 12, 60, 300, 600, 1200 (100,000 / V).
AC Volts: 6, 30, 120, 300, 1200 (10,000 / V).
DC Current: 12A, 300A, 6mA, 60mA, 600mA, 12 amps. AC Current 12 amps.
Resistance: 20K, 200K, 2M, 20M.
Decibels: – 20 to +17, 31, 43, 51, 63.
Accuracy: DC ±3 per cent. AC ± 4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, "Eveready" 915.

"HANDYMAN" RH150 $11.50

CHECKED PACKED & POSTED $12.00

Pocket-size 3¼" x 4½" x 1¼".
Instruction sheet and circuit.

SPECIFICATIONS:
DC Volts: 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: .1, 25, 250mA.
Resistance: 20K and 2M.
Decibels: —20db, +62dB, 0.7KHz.
Capacitance: .0001, .01, .0025, .25uF

MODEL RH-20 $15.00 Packing & Postage 75c

20,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.
Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current, 50uA, 25mA, 250mA.
Resistance: 7K, 700K, 7M.
Decibels: —10, +22 (at AC / 10V) + 20, +36 (at AC / 50V). Upper frequency limit uKHz.
Batteries: Two 1.5V dry cells.
With overload protection $18.00.

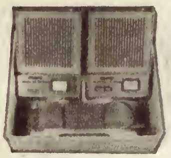
MODEL RH-80 $20.00 Packing & Postage 75c

20,000 Ohms per volt DC.
10,000 Ohms per volt AC.
Specifications:
DC Volts: 0.5, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 50uA, 5mA, 50mA, 500mA.
Resistance: 5K, 50K, 500K, 5M.
Decibels: —10dB + 62dB.
Accuracy: DC 3pc.
AC 4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, "Eveready" 915.

• Overload protected by dual silicon diodes • Double-jewelled ±2 per cent meter • ±1 per cent temperature-stabilised film resistors • Mirror scale.

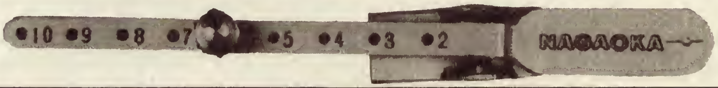
"HOMER"

2 station intercom



$12.75 complete
Post & packing 75c

STYLUS PRESSURE GAUGE, Balance type NW-501



$1.50 Posted

RADIO HOUSE PTY. LTD.

306-308 PITT STREET 61-3832 26-2817 760 GEORGE STREET SYDNEY. 211-0171

ANSWERS TO CORRESPONDENTS

60 WATT GUITAR AMP: I recently constructed the Playmaster 117 60-watt Guitar Amplifier and find that a loss of volume is incurred as the vibrato depth control is advanced, and that the volume level almost doubles as the bass control is advanced. If I built a second 60 watt amplifier, would there be some way in which I could connect the two together in order to make a 120 watt system? I am also very interested in echo effects. Do you have any material available on this? (R.D., Belfield, NSW).

The vibrato section of the 60 watt guitar amplifier uses a bridge circuit, one arm of which is an LDR illuminated by a neon lamp. Loss of volume will be due to the use of a high limit LDR. When illuminated by the neon, this is apparently exhibiting a static resistance of less than 15K, the value on the opposite side of the bridge, thus upsetting its balance. To overcome the problem disconnect one lead of the LDR and place an ohmeter across it. Disable oscillation of the vibrato oscillator, and increase the value of the cathode resistor of the oscillator valve to a value which will produce a reading of 15K across the LDR. Reconnect the LDR into circuit. An open circuit capacitor or unsoldered connection may be the cause of the bass control acting like a volume control. Check around this section of the circuit. A second 60 watt amplifier may be connected to the existing amplifier just after the bass and treble circuits. Your duplicate amplifer should only require the essential stages of the original circuit up to just after the bass and treble control circuit. Ideally, the amplifiers should feed their own separate speaker systems, properly phased for best acoustic efficiency. Articles on the subject of reverberation were published in the Dec 1962 and the Oct 1967 issues. Reprints of the articles are available through the Reprint Service for 50c each, under file numbers 1/GA/6 and 1/GA/12, respectively.

LIGHTING: I have been intending to write for some time, but the very interesting article on Psychedelic Lighting in the February issue jogged my memory. I made a musicolour unit from an English publication a few years ago, but thought my display might be interesting. I used translucent spheres in my living room, with six coloured BC globes in each, two for each channel. As well as the musicolour unit, I have constructed the EA light dimmer, which I use for controlling the main (white) light in the room, and so help to make the display less tiring. By the way, is there anything on the drawing board for a ring modulator for electronic music? (V.S., Higgins ACT.)

Thank you for your comments on the article, and also on your display. Other readers also might prefer the idea of increasing the ambient light level, which we agree would enable you to "live with" the special lights for a much longer time. At the moment there is nothing planned for a ring modulator for electronic music.

EX-ARMY RECEIVER: I have an old ex-army receiver unit, type R5019, but it is not complete. Could you let me know where to get more information on it. Thank you. (Mr G. Gale, 15 Derby Street, Merrylands, NSW 2160.)

We have no idea where you can find the information you require. However, we have published your full name and address so that any reader who can help can forward the information directly to you.

SIGNAL TRACER: As a spare time venture I have taken on servicing small transistor radios, but sometimes I strike difficulties due to lack of equipment. As I have a couple of these sets available as spares, could I convert one to a signal tracer by altering the IF stages for extra audio gain? I realise a modification will be required around the second detector. Has your magazine featured such a modification to a transistor radio? (J. S., Primbee, NSW).

The only useful section which a transistor radio will yield for a signal tracer would be the audio amplifier, as it is not a simple matter to "hookup" a few components here and there to convert the RF section into an audio one. A rebuild here will be necessary — and you can certainly use the RF transistors as part of your new audio preamp. Unfortunately, we have never published an article specifically aimed at transistor radio conversions into signal tracers. Those signal tracers we have described are all designed to be built up from scratch.

PSYCHEDELIC LIGHTING: We have used a combined motor/gearbox, as used in "Email" oven rotisseries, to operate colour wheels in stage shows. They cost about $9, rotate at 3.6rpm and have proven very successful. Cellophane is not very suitable for lighting. A self extinguishing acetate called "Cinemoid" is manufactured in about 65 shades for this purpose. It is available from Strand Electric or its representatives. I hope this information will improve the already fine article. (B.D. Edge Hill, Qld.)

Thank you for the information on the motor and film. However, the author sees at least one problem with the "Email" motor. Oven rotisseries are invariably horizontal, so the motor would probably not be equipped with bearings capable of operating under some modes envisaged in the article. However, for colourwheels, (operated at or near horizontal) they should be satisfactory. The author was aware of the "Cinemoid" film, but did not mention it for a number of reasons. Among these were the price — it is not cheap — and the fact that it must be bought in full sheets — more than the average user requires. However, for those who would like it, they now have the information necessary. Thank you for the comments on the article.

GRID DIP OSCILLATOR: I am attempting to build a 3-valve meterless grid dip oscillator. I have no coil details, so I intend to work them out using a coil inductance formula. Could you please supply me with a suitable coil inductance formula? Also, have you ever published details of a television receiver or oscilloscope? (G.G., Gunnedah, NSW.)

It is quite possible to calculate the inductance of each of the coils required, using a suitable formula which may be obtained from many textbooks. However, this can be quite a tedious task and it is often prudent to use details which have already been worked out and are known to be satisfactory. We described an AC Grid Dip Oscillator which should meet your need, in June and July, 1955. It covers the frequency range from 450KHz to about 87MHz with eight plug-in coils. The indicator is a "magic eye". (File No 7/RO/18.). We have described many TV receivers and oscilloscopes in the past though most of them are rather dated. If you give more specific details as to what kind of unit is required, we will do what we can to help. The cost of each article is 50c and may be obtained through the Information Service.

"ELECTRONICS AUSTRALIA" INFORMATION SERVICES

As a service to readers "Electronics Australia" is able to offer: (1) Project reprints, metal work dyelines, photographs, printed wiring patterns and other filed material to do with constructional projects and (2) A strictly limited degree of assistance by mail or through the columns of the magazine. Details are set out below:

PROJECT REPRINTS: These cost 50c per project. Prior to December 1959, circuits and diagrams only are available. From December 1959 onwards, complete articles are available. No material can be supplied, additional to that already published. Reprints can be supplied more speedily if they are positively identified and not accompanied by technical queries. Material not on file can normally be supplied in photostat form at 30c per page.

SUBSCRIPTIONS, BINDERS, HANDBOOKS etc: These are handled by seperate departments. For fastest service, send separate orders to the departments concerned.

PHOTOGRAPHS, METAL WORK DRAWINGS: Original photographs are available for most projects. Price: $1 for 6in x 8in glossy print. Metal work dyelines are available for most projects. Price: $1 These show dimensions and positions of holes and cut-outs, but give no wiring details.

PRINTED WIRING PATTERNS: We can supply negative transparencies, actual size. Price: 50c. We do NOT deal in manufactured boards. These are available from advertisers.

BACK NUMBERS: As available. On issues up to six months, face value. Seven months to 12 months, face value plus 5c. Thirteen months or older, face value plus 10c. Postage and packing, 10c per issue extra. Please indicate if a PROJECT REPRINT may be substituted if the complete issue is not available.

REPLIES BY POST: These are provided to assist readers encountering problems in the construction of our projects published within the last two years. Note, particularly, that we cannot provide lengthy answers, or undertake special research or modifications to basic designs. Charge: 50c. Inclusion of an additional fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee and may be answered in the magazine at the discretion of the Editor. Technical queries will not be answered by interview or telephone.

COMMERCIAL EQUIPMENT: "Electronics Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals equipment etc. We are therefore not in a position to comment on any aspect of such equipment.

COMPONENTS: "Electronics Australia" does not deal in electronic components. Prices, specifications etc should be sought from appropriate advertisers or agents.

REMITTANCES: These must be negotiable in Australia. Where the exact charge may be in doubt, we recommend submitting an open cheque, endorsed with a suitable limitation.

POSTAGE & PACKING: All charges shown include postage and packing, unless otherwise specified.

ADDRESS: All requests for data and information should be directed to the Assistant Editor, "Electronics Australia", Box 2728, GPO Sydney, NSW, 2001 — (10/71)

THE LATE RAY ALLSOP

Raymond Coltam Allsop, one of the best known radio pioneers in Australia, died suddenly on March 19 at the age of 75.

Ray Allsop played a vital part in many aspects of the fledgling radio industry in Australia and his name is encountered again and again in literature covering the period from the early twenties to the present day.

A great deal could be said about the late Ray Allsop but, to one who knew him well, three impressions are uppermost.

One was his involvement in the early days of sound motion pictures and his courage in promoting locally-made projectors against the products of industry giants.

Who, amongst the older generation, can forget his demonstration of compatible stereo sound reproduction, literally decades before it was taken seriously by the film industry.

My second impression of Ray Allsop was his dedication to the cause of frequency modulated sound broadcasting. A personal friend of FM pioneer the late Major Armstrong, Ray never lost an opportunity to represent the cause of FM broadcasting in high places, in technical literature and in the daily press. He leaves it to others to carry on a campaign which has yet to be won.

Finally, I must mention Ray Allsop's keen sense of history. More than any of his contempories, he seemed to have preserved an unfailing mental and physical file of past events. Time and again, at the office and at home, he would ring me with comment on something that had appeared in these pages. He would offer names, occasions, dates and actual quotes that would enlighten — but disturb — a less systematic mortal.

As always, it seems lamentable that, with the passing of such a pioneer, another link with history has been broken; another window overlooking the past has been shuttered.

How strange it is that we tend not to worry too much about history till the people have gone and only the dusty documents remain!

Neville Williams

"SUPERNATURAL" RECORDING: I read with delight your article in the September '71 issue on "Spook Easy". I tried it out with a microphone and a cassette player and got some "snatches". Most tape recorders use a bias oscillator. Signals which differ from the bias frequency by an audio amount might be transformed into audio by superheterodyne action. (G.R., Como, NSW).

We attributed the spasmodic recording mainly to normal penetration of RF energy into low-level audio circuits and to rectification (or detection) due to non-linearity of the input circuits. We agree that a heterodyne effect could occur involving not only the main bias frequency but also a whole range of harmonics of the bias frequency. Much would depend on the harmonic content of the bias oscillator and the amount of bias energy reaching the audio input circuits. An interesting thought and another reason to question the validity of the observations!

COURSE: I am enquiring about a course for an amateur radio licence. It was in Electronics Australia some time back, but I am not sure of the date. It cost two dollars. I was wondering if you knew of any such course now. (A.W., Bundaberg, Qld.)

A number of our advertisers have offered courses leading to the examination for an amateur licence, but we cannot recall any which were as low as two dollars. We feel you may be confusing this with our handbooks, which are priced at two dollars. The information in the handbooks, particularly "Basic Electronics", would be good background material, but not enough, by itself, to pass the amateur operator's certificate examination. The Wireless Institute of Australia also offers its courses through various divisions which lead to the amateur licence examination. Further information may be obtained from the Wireless Institute branch in your capital city.

MINIATURE AIR-CUSHION VEHICLE: Do you have any plans for a home-made air-cushion vehicle to carry two people and using a 1200cc engine? If not, do you know where I could find some? I used to buy "Modern World" regularly, but for about six months my newsagent has not had them. If it is still published, can I obtain it from your office? (R.D., Darwin, NT.)

The design and construction of projects of this type is quite outside the scope of this magazine's activities. We are afraid we can offer no assistance whatsoever. "Modern World" ceased publication last August, as a direct result of the withdrawal of Commonwealth subsidies for certain types of publications.

ELECTRONIC ECHO: We are interested in tape recording and sound effects, and would like to know if you have published an electronic echo unit. Our compliments on a great magazine — keep up the good work. (R.B. & A.K., Frankston, Vic.)

Thank you for your comments about the magazine, R.B. & R.K. At the present state of the art, fully electronic echo can be achieved only through a very expensive analog-to-digital-to-analog conversion technique, employing literally thousands of transistor functions for less than half a second's delay! (see "Forum", April 1972 issue). It is more usual to use less exotic techniques, varying in cost structure but still a fraction of the price of the all-electronic system), which include tape recording techniques, large metal plates to which suitable transducers are attached, long coiled pipes with acoustic transducers at each end, or the common — and cheapest — spring reverb unit.

An article was published in the Oct 1967 issue giving details of a spring reverb system. Reprints of the article are available from this office for 50c each under file number 1/GA/12.

STROBE PHOTOGRAPHY: Have you ever published a strobe flash for use in photography. I would prefer battery operation, and a reliable, portable unit. As well as the fast succession, single flash would also be desirable. (J.P., Junee, NSW).

We have never published details of a strobe flash as such, J.P. We have published an electronic flash unit (Sept-Dec 1966, file nos 3/EF/7,8,9,10.) A stroboscope which was mainly intended for timing purposes, was published in Sept 1970 (file no 7/SC/3). This unit may be useful in the role you envisage, particularly with a very fast film (at least 400 ASA or more). We can see many problems with a battery portable unit not the least being the life of the batteries. However, we will file your request to see what can be done when time is available.

CDI FOR MOTORCYCLES: I would like to fit a CDI system to my two racing motorcycles, each being two stroke with two and three cylinders. Also, on each, there is no distributor, but a set of breaker points and a separate coil for each cylinder. Can the CDI system published in the Aug 1970 issue of EA be adapted to these motorcycles in an effort to reduce misfiring and increase plug life? (R.M., Haymarket, NSW).

We have had quite a few requests for a CDI system for distributorless motorcycles, R.M. To adapt the CDI system of Aug 1970 to this role, you could possibly use the principle of the trigger circuit of the "Hot Seat" (Nov 1971 issue) with the CDI's power supply and capacitor circuit, triggering each thyristor from the respective breaker points. In using multiple triggering circuits, exercise care in your layout and return paths, as the heavy discharge from one circuit could trigger another prematurely. We are sorry that we cannot offer more detailed assistance at this time.

PLAYMASTER 128: Is there now available a suitable transformer to enable the full 64 watts per channel to be obtained from the Playmaster 128 stereo amplifier described in January 1970? (T.J., Corrigin, W.A.)

The Ferguson PF3259 or A&R PT7369, as used in the Playmaster 132 stereo amplifier described in June, July and August 1971, should be suitable.

50Hz INVERTERS: Has "Electronics Australia" ever published circuits for inverters operating at 50Hz from a 6V or 12V source giving an output of 240V? My primary interest in these is to operate radios, shavers, and similar devices. Having built the Transistor Tester described in the Aug 1971 issue, I have felt that accidental shorts placed across the terminals could cause injury to the meter. Is this so? I have found your article "Five One-Transistor Projects" very interesting, and

SOUND PROJECTORS
Cinevox Prefect and Harmour and Heath 16mm in good working order. 240v operated, complete with speaker and amplifier.
from $115.00

CIRCULAR SLIDE RULE
3¾in diameter. Will do the same work as the conventional slide rule. Instruction book included.
from $1.25 each
Post 12c.

P.M.G. TYPE TELEPHONES
Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.
$25.00
(2 TELEPHONE SETS)
30c. cartage to rail. Freight payable at nearest attended railway station. Please note we are now able to include ¼ mile of twin telephone cable FREE with each set of phones.

BATTERY CHARGERS
240 volt AC input
Each battery Charger will charge either 6 or 12 volt batteries.
2 amp without meter $15.75
2 amp with meter $17.75
Post N.S.W. 95c.; Interstate $1.20.

MINIATURE ELECTRIC MOTORS
1½ to 3 volts DC. Ideal for model boats, cars, planes, etc. Strong torque. Only
65c. each or 10 for $4
(Post 12c.)

TRANSCEIVER
(2-way radio) R.C.A. America RT 68, 24 volt, operated 10 watt output 38-54MHz F.M. crystal locked. Transmitter and receiver using frequency synthesiser in 100KHz; step 10 channel per MHz with power supply, mike, and headphones. $45. 60c. cartage to rail. Freight payable at nearest attended railway station.

TRANSCEIVER
(2-way radio) 62 set, 12V, operation. Ideal Hams, etc. 1.6 to 10MHz. Crystal locked or VFO controlled. 5 watt output. Complete with antenna, headphones and mike. $60. 30c. cartage to rail. Freight payable at nearest attended railway station.

HEADPHONES
Low impedance moving coil fitted with rubber muffler to reduce external noise, fitted with press to talk, dynamic hand microphones. Ideal for use with all types of transceivers. $3.50 pair.
Post N.S.W. 45c.; Interstate 65c.

COLLINS TRANSCEIVERS
Auto-tuned 100-150MHz. 10 channels.
$65.00

HALF-INCH RECORDING TAPE
Top grade 2400' on 10½" reels. Ideal video experimenting. Only $1.50 per reel.
Post N.S.W. 45c.; Interstate 75c.

LAVOIE HETERODYNE FREQUENCY METERS
10-100MHz. LA5 $250.

100-500MHz. $350.

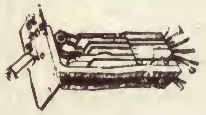
ADLER FREQUENCY METER
100KHz-20MHz. $175.

4 DIGIT RELAY COUNTERS
50-volt DC, suit slot car. Lap counters, etc.
$1.25 each. Post 18c.

NIBBLING TOOL
Cuts sheet metal like a punch and die, trims, notches and cuts to any size or shape over 7/16-inch.
ONLY $6.50
Post 74c.

NIFE CELLS
1.2 Volt, fully charged, 4in x 3in x 1in 4 AH.
$1 each.
Post N.S.W. 25c. Interstate 35c.
3.6V 10AH, set of three batteries in wooden holder, $7.50 per set or $2.50 per battery 1-2 volt 10AH.
Post N.S.W. $1.10; Interstate $2.72.

COMMAND RECEIVERS
Q5 190-550 K/CS. $22.50
6 TO 9 M/CS. $15.00
POST: N.S.W. $1.25, INT. $1.44



P.M.G. TYPE KEY SWITCHES.
45c each. Post 24c.

TELESCOPES
30 x 40 with Tripod.
$7.95
Post N.S.W. 95c; Interstate $1.45

30 x 30 Power Coated Lens. Brand New.
$3.75.

50 magnification with a 60mm coated objective lens. With tripod.
$27.95
As illustrated.
Postage $1.20; Interstate $1.45.

BC221
Frequency Meters.
$55.00

SMALL COMPUTER PANELS
3in x 2in containing 2 valves, qty. of resistors, etc.
ONLY 75c.
Post 24c.

COMMAND TRANSMITTERS
5-3-7 M/CS. $10.00
Post: N.S.W. $1.25 Int. $1.44

TYPE S POWER SUPPLY
(240 V/AC supply for AT 5-ARB). Suit most types of Disposal transmitters and receivers. Outputs 250 volt, 10mA, 550 volt 200mA, 300 volt 100mA. $30.

BC348 RECEIVER $80.00

A.W.A. B.F.O. TYPE R7077
1-800 CYCLES
1-13 K/CS. $30.00

Seven foot width aerials
$3.50

522 Trancelvers
100-150 M/CS
$35.00

ELECTRONIC COUNTER
(Austronic) 0-100KHz. 240V operated.
$150

Cossor Double Beam Oscilloscope 1035. Tested.
$150

VALVES
BRAND NEW
IN CARTONS

Special discount for quality

807	75c	CV850	$1.50
65N7GT	95c	1H6G	30c
8989	$1.00	832	$5.00
5U4G	95c	6AK5	$1.50
EF50	35c	6X4	$1.00
5Y3	$1.75	12SK7	50c
6C4	50c	VR65	25c
2 x 2	75c	VT4C	75c
6AG5	80c	80	$1.25
12AU7	$1.00		

Please add postage on all articles

RADAR TRANSCEIVER
X BAND WITH KLYSTRON ETC. $45.00

TRANSMITTERS ARC 49
100-165 M/CS $25.00

CHASSIS PUNCH SET
Five sizes: ⅝-inch, ¾-inch, ⅞-inch, 1-inch and 1⅛-inches. With taper reamer.
$7.50
Post, $1.15

SELSYN MOTORS MAGSLIP Mk. II .... $5.25 ea.
No. 19 TWO-WAY RADIOS.
Power supply, accessories, etc., $35.

BINOCULARS
PRISMATIC. Coated Lenses. Brand new. Complete with case.

6 x 30	$12.50
8 x 30	$19.95
7 x 50	$24.50
10 x 50	$25.50
12 x 50	$26.50
20 x 50	$29.50

Post N.S.W 95c; Interstate $1.45.

3000 TYPE RELAYS
P.M.G. 200 Ohms — 1,500 Onm Coils. $1.25 each. Post 24c.

TOGGLE SWITCHES
Brand new, 3 amp, 240 volt. S.P., S.T. 39c each or 10 for $3.
Add postage.

Cintel Oscillator and Electronic Counter, type 388. $250.

SPECIAL lucky dip valve offer, 15 new valves in cartons for only $2. We haven't got time to sort them, so you reap the benefit.
Post 75c.

CONDENSER LENS
1½in diam. 1½FL. 50c each.
Postage 24c.

MINE DETECTORS
Ex A.M.F. with Instruction Book. Complete in wooden case. Ideal for plumbers, councils for locating buried pipes, etc. Freight payable at nearest attended railway station. $39.00

ALTEC STUDIO MICROPHONES
639B Western Electric, top grade. Original cost $250, ideal Broadcast Studio, music recording. Church and play recording, etc.
Fraction of original cost.
Price on application.

SPECIAL PURCHASE TOP GRADE RECORDING TAPES
Brand new, from well-known maker. Sorry, we cannot divulge brand name. 7" x 2,400' Mylar in plain carton.
Only $3.50 ea. Post 35c.

SOLENOIDS
Plunger Type 12V 300MA. Suit electric camera control, miniature trains, radio, etc.
$1.25. Post 24c.
200 MA 24 volt, ⅛in push movement.
$1.25. Post 24c.

CONDENSER LENS
2½in DIAM. 2in FL. $1.50 each. Or $2.50 per pair. Post 24c.

11/16 inch Tape printer with keyboard
$35.00

FIELD STRENGTH METERS
144 M/CS. $12.50

TEN CHANNELS VHF TRANSCEIVER
Types TR 1934 100-125 MHz and TR 1935 125-150 MHz. 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator. $33.00

RECORDING TAPES
TOP QUALITY, BRAND NEW

		Post
3" x 150'	65c	12c
3¼" x 600'	1.58	13c
5" x 900'	1.95	13c
5" x 1800'	3.62	13c
7" x 1200'	3.18	24c
7" x 2400'	4.80	74c
7" x 3600'	6.45	74c

CASSETTE TAPES
C60 $1.15; C90 $1.75; C120, $2.25
Post 13c.

Crystal Earphone 75c

Cassette head cleaners $1.95

Small Lapel Microphones, ea. $1.25
Post 24c.

DUMPY LEVELS
Made by Watts, excellent condition with tripod. $77.50

BYER 77 Mk. 1
Rack Mounting Tape Recorder ex A.B.C. 7½-15 ips. Full track tested $150.

Microphone. Professional S.T.C. type 4017. $20.

Marconi Video Oscillator type TF885A 0-12 MHz. $75.

A.W.A. SIG GENERATOR
UHF 140-300 MHz $65.00

Pye 4 Channel Crystal Locked Oscillator, 1.5-30 MHz New. $25

TRANSPONDER APX6
with Lighthouse Tubes. Can be converted to 1200 MHz. $17.

RECEIVERS ARC 49
100-165 M/CS $25.00

Deitch Bros.
70 OXFORD STREET, SYDNEY 2010
SORRY, NO C.O.D.

have constructed a few of them using different types of transistors. I have also found that the "Edison" intercom works well with a pickup coil for amplifying telephone signals. Do you have any circuits for matching low impedance devices to high impedance amplifiers? And is it possible to find the output of home-made amplifiers measuring voltages and currents? I have enclosed a small amplifer circuit for "Circuit Design and Ideas". (B.P., Albion Park, NSW).

Thank you for your contribution to CDI, B.P. This has been filed for possible future use. From your request, we assume that you are referring to a converter which gives a sinusoidal output. Such a converter would be equivalent to a very high-powered high-performance amplifier, driven from a 50Hz oscillator, and involving a high-power step-up transformer! It would be a very expensive project. Simpler circuits would involve either a vibrator (operating at 100Hz) or two switching transistors or thyristors. These types of converter give a square wave output. Articles describing mechanical vibrator designs were published in the October and November, 1948; April, 1952; September, 1953; January, 1957; and February 1960 issues. Copies of the essential diagrams are available through the Information Service for 50c each in the case of the earlier articles. The 1960 article is available complete for the 50c fee. They have only limited usefulness. Although the meter in the August 1971 checker may seem grossly overloaded under short-circuit conditions, the overload is about 10 times FSD — within the overload limit of the meter. We are glad that the transistor projects proved interesting, and that you found a secondary use for the intercom. Because the subject of impedance matching devices and / or circuits is broad, you would have to be more specific as to your requirements. Output power measurements of amplifiers cannot be made by reading DC voltages and currents directly, but would involve an audio generator, load resistances, and AC voltmeter, and an oscilloscope to monitor the waveform.

ORGAN: First of all I must congratulate you on the home study course, which I have been following carefully. I am considering building your beginner's organ which appeared in the February 1972 issue. I would like to extend its range by adding further resistors, and also provide chords. Could you give me further resistor values. (M.C., Panania, NSW.)

Thank you for the comments on the Home Study Course. Regarding the organ, as we stated in the article, it is virtually impossible to provide chords on an organ of this type. To do this would require a separate oscillator for each note — a prohibitively costly undertaking. We do not recommend you extend the range by adding more resistors — the transistor may not oscillate reliably much beyond the range given.

NEW DESINGS WANTED: I have been reading "Electronics Australia" for over ten years and have enjoyed building some of your circuits. As the year is now 1972, I would like to ask if it is possible to publish new designs for an RF signal generator and a CRO. The latter could perhaps be all solid state with a wider bandwidth, consistent with cost, of course, and possibly using the same tube as in the 1966 CRO. I hope you will give some consideration to both requests and not spend too much time on silly or useless projects such as the Hotseat and the Musicolour. (D.T., Traralgon, Vic.)

We published a solid-state RF test oscillator in March, 1968 (File No 7 RO 41) which is still a current design. The idea of a solid-state CRO is one which we have considered. However, over and above the time and space necessary to produce a design, there is the problem that it may well be possible to buy a small commercial CRO for less than it would cost to build one. Without a reasonable financial incentive, such a project could prove a flop. Incidentally, many of our readers would disagree with you on projects such as the "Hotseat" and "Musicolour". The latter, in particular, has proved to be a very popular project over the years.

ROBOT: I was wondering if you can help me. I have built a robot (just a statue at present) and would like a remote control system of some kind so he can move, mainly forward and reverse. Have you any ideas? (G.B., Greenacre, NSW.)

Sorry, G.B., but there is very little we can offer. Apart from 27MHz radio control, we have not described much along these lines. Perhaps you might be able to adapt our "Remote Power Control" receiver and transmitter, which we described in the October and November 1970 issues (File Nos. 2 / MC 6&7) These contained much of the electronics which you would need, as well as thoughts on auxillary equipment.

INPUT / OUTPUT CIRCUIT SYMBOLS: While reading your magazine for over a year, I have had little trouble with circuit diagrams. However, I have come across a sysmbol in some circuits that is supposed to indicate an input or output:

Is this a new way of showing inputs and outputs? Why is it used in some circuits and not in others? Also, do you know of any way in which an IC can be tested before inserting it into circuit? (T.H. Ballarat, Vic).

The symbol to which you are referring is that for a coaxial connector. The reason that it is found in some circuits and not others is the simple one that not all projects need, or can use, this type of connector. There is no simple way to test an IC before wiring it into circuit, as such tests call for special equipment.

PSYCHEDELIC LIGHTING: I enjoyed reading your article very much. The cost of the home-made mirror ball is well below those from some commercial sources. By varying the angles of the illuminating spots and the filters a great variety of effects can be obtained. Experimentation in the various situations is well worth while. For an interesting effect, use six spotlights, if possible with the light concentration onto the ball, three each side, in three different colours. These should be one to two feet behind each other, illuminating the ball from the standard theatrical lighting angle of 45 degrees in the vertical and horizontal. By fading between lights or leaving certain combinations, an immense variety of unusual effects is available. The section concerning the danger of ultraviolet light should arouse some concern. Many discotheques use this excessively with mains lighting off, possibly causing irreparable damage to the eyes of the weekly fans. They should be made aware of their responsibilities in this respect. The main reason why I wrote, however, was to inform your readers of a suitable material for use in colour wheels and in colouring spots generally. The material is called Cinemoid filter, manufactured by The Strand Electric Company, and is available in Sydney and Melbourne. It is widely used in theatrical lighting and is very easy to handle. A wide range of colours is available in full sheets size 49in x 21in, and half sheets of 24in x 21in. It is a self-extinguishing acetate sheeting. (N.Z., Strathmore, Vic.)

Thank you for the information, N.Z., which we are sure a lot of readers will appreciate. We do not have the space of print the full list of colours you provided, but no doubt interested readers will be able to obtain this information from the makers, and will be able to select these which best suit their requirements. We certainly hope that our article may point out the dangers of ultraviolet light to those who are possibly not aware of the dangers associated with its indiscriminate use.

Serviceman — from p65

trade were not good, but they were available from the set manufacturer's service department. Since I had other business to conduct in the vicinity, I decided to pick up what I needed personally.

By a happy chance, the fellow who served me apparently knew more about the problem than most of his colleagues. When I happened to mention — casually on purpose — the trouble I had experienced, he was quick to point out that there was a very critical adjustment associated with this stage; an adjustment which, if not made correctly, could cause transistor failure.

In essence, it concerned the pulse waveform at the output transformer tap which connected to the transistor. As shown in the manufacturer's data it had a small double hump at the top of the pulse and, although no special mention had been made of this, it appeared that this double hump was a vital indication that the output transformer was correctly tuned. If this hump was not present, there was a grave risk of transistor failure.

To tune the circuit, I was told, one had to vary the tension on the transformer assembly bolts, this — apparently — causing a slight variation in the gap between the two halves of the core.

All of which was very interesting, but the piece-de-resistance was yet to come. "Of course," he added, "there is always a risk that you will do in a transistor in the process of making the adjustment."

Perhaps I should mention that these transistors cost me nearly six dollars each and by the time tax and mark-up has been added they cost the customer around nine dollars.

All things considered, it struck me as a most unsatisfactory situation. Not only is the method of tuning the system rather crude, but on top of that it involves a very real risk that one may destroy one or more transistors, at six dollars a time, before the adjustment is completed.

I didn't say much right then, except to thank the bloke. After all, he had supplied some vital information, even if the implications weren't very palatable. But I realised that I had to make a decision. Should I attempt this adjustment with the set now on my bench, or should I, as of now, make it a policy to divert all such problems to the maker's own service department?

By the time I reached my shop I had made up my mind. For this job, and any future ones, the manufacturer could take the risk of wrecking expensive transistors; I wasn't interested.

Again, the story raises a number of questions. How is the average serviceman expected to keep pace with the innumerable modifications, which failure to master the solid state techniques seems to be creating, when some of these are not even available in printed form, and not even the maker's service department is fully aware of them?

And even assuming that this problem is eventually overcome, can the maker reasonably expect the serviceman to carry out an adjusting technique as risky as the one described?

On the other hand, is there a safer way of making the same adjustment? I feel sure there must be but, if there is, why hasn't it

been publicised or, at any rate, made available to bona fide servicemen who request it?

Small wonder if servicemen are rapidly coming to the conclusion that some manufacturers couldn't care less about service and the servicing section of the industry.

And I'm one of them!

4 Channel Disc from p29

ultimate. It has definite limitations and relies significantly on simulation.

What of the future?

Well, matrixed quadraphonic may meet industry and user needs for the foreseeable future. It certainly has a lot going for it:

The records are here now and they are fully compatible with present-day players. The kind of decoding equipment which is necessary to process them can also be used to simulate quadraphonic sound from present discs and even expand mono discs where this seems desirable.

Matrixed quadraphonic is equally applicable to twin-channel stereo tape machines and Stereo / FM broadcasting. And it has the backing of numerous record and equipment manufacturers.

But . . . and it is a very significant but.

It is not a "discrete" system. The four channels are not genuinely independent. If the market ultimately demands that they should be, the matrixed system will have to give way to something else — either four tracks on tape, or the JVC / Panasonic / RCA multiplex system on disc, involving a superimposed carrier.

But that is another story.

MARKETPLACE

FOR SALE

WE SELL construction plans. TELEVISION: 3 D converter, $25 camera, Kinescoping recorder, VTR, colour convertor. HOBBYIST: Electron microscope, 96-hour music system, voice typewriter, Morse code to typewriter copier, transistorised teletype. TELEPHONE: Answering machine, pushbutton dialer, phonevision, auto-dialer, telephone extension in your automobile, legal connector. SECURITY: Microphone jammer, voice scrambler, microdot photography. Plans $5.00, air shipped from our USA research labs. COURSES: Telephone engineering $39.50, security electronics $27.50, Investigative electronics $22.50. Super hobby catalogue air mailed $1.00. Payment accepted in dollars (Australian, New Zealand or US). Don Britton Enterprises, Suite 28, 280 Pitt Street, Sydney, Australia.

BACK issues Electronics Australia stocked, 50c each, prompt service, post free. T. Weir, 56 O'Connor Street, Haberfield, NSW 2045. Phone 798 7569. Wanted to buy copies also.

HI-FI equipment. We import famous Lowther speakers and Class A amplifers for music lovers who want the best. We also stock Quad, Goodmans, Dual, Jordan Watts, Tandberg, Revox, Sony, Sansui, AWA, Wharfedale, Thorens, Decca, Ribbon tweeters, etc, etc. Encel Hi-Fi. For superb fidelity, Duratone, Mail Order, PO Box 125, Curtin, ACT. Demonstrations, phone Canberra 81 2549.

ROSEVILLE Ham, modulate line, add 4 12V modules for 80W. Linear amps various bandwidths within 5kHz-250mHz for laboratory use. NATO band 2-30MHz continuous, 12-40V, from 50 per watt PEP to 500W. Newman, 27 Berry 2143. SAE.

LONELY? Unable to meet friends easily? Then write for the "Lonely Hearts Magazine", containing photos, names and addresses. Send 30c (stamps) to Tropic Mall, C O GPO Box 4392E Sydney, 2001.

TAPEDECK "Collaro" Model SV, 4 heads, 3 speed $45. 15 Whitford Road, Elizabeth Sth, SA.

SUPER BARGAIN SPECIALS from **MICRONICS**. Copper Clad Board 6" x 3" at the ridiculous price of 10c ea. Ferric Chloride etchant (solid) 100gm bag — 40c. Capacitors (600V) .001uf, .002uf — 3c ea. **INTEGRATED CIRCUITS** — Fu1900, 914-$1.20 ea, Fu1923, 703, 741c — $2.50 ea, M5102AY 3W RMS audio amp IC — $5.95 incl tech data. **SEMICONDUCTORS** — OA91 — 20c, BC107 — 50c, BC108, 109-45c ea, AC127-50c ea, AC187, 188-70c ea, AD161, 162-$1.30 ea. **RESISTORS** — Carbon film, ½w, 5%. High stability, E.12 values 10-10M 4c ea. **POLYESTER FILM CAPACITORS SUB** miniature "GREENCAP". Top quality. 100VW: .001, .0015, .0022, .0033, .0039, .0047, .0056, .0068, .0082, .01, .015, .022-10c ea, .033, .039-12c ea, .047, .056-14c ea, .068, .082-16c ea, 0.1-18c, 0.15-20c, 0.22-22c **ELECTROLYTICS** — High stabilility, miniature, single ended, **25VW**: 4.7uF-15c, 10uF-17c, 25uF-19c, 50uF-21c, 100uF-24c, 200uF-28c, 470uF-38c, 1000uF-58c. **50VW**: 4.7uF-18c, 10uF-21c, 25uF-23c, 47uF-25c, 100uF-30c, 220uF-42c, 470uF-70c. **PRE-SET POTS** — Miniature (10mm). Range 500, 1K 2k, 5k, 10k, 25k, 50k, 100k, 250k, 500k, 1M, 2M only 20c ea. **TANTALUM** Capacitors, miniature, single ended. ELNA type: 0.1uF, 0.47uF, 1uF, 2.2uF, 3.3uF (35V), 4.7uF, 6.8uF (25V), 10uF (16V), 15uF (10V), 22uF (6.3V) — all 35c ea. **CERAMIC CAPACITORS SUB** miniature — top quality **50VW**: 220pF, 330pF, 470pF, .001, .002, .005, .01, .02uF — 6c ea. .03, .04, .05uF — 7c ea. Post pack 20c. **MICRONICS**, PO Box 175, Randwick, NSW 2031.

TRANSCEIVERS, 27MHz, 5w, solid state, 12 channels, base mobile, AC DC, retail $178, sell new $98 each. Bondi TV, PO Box 34, Bondi, NSW 2026. Ph Sydney 389 1712.

SELL OC44, 45, 71, 72, BC108, 109, 6 for $2 or 40c ea. AC128, OC84, 2N3638, 2N3641, 42, 43, 5 for $2 or 50c ea. AC127, AF115N, 116N, 117N, BC107, BF115, 4 for $2 or 60c ea. AC187 188, $1.40 pr. AD161 162, $2.40 pr. Power types 2N176, $1.20 ea. 2N174, $3 ea. OC28, 29, 35, 36, ASZ15, 16, 17, BDY20, 40251, 2N301, 2N3055, all $1.40 ea or 10 for $12. OA210, BY126, EM404, 1N4004, 30c ea. OA211, BY100, BY127, EM410, 70c ea. UJT 2N2160, FET 2N4360, 10 for $7 or 90c ea. 2N3819, 10 for $6 or 80c ea, MPF105, 2N5459, 80c ea. BA100, 20c ea. OA81, 85, 91, 95, 20 for $2 or 15c ea. TDK super dynamic cassettes, C90, $3 ea. Also SCRs & triacs. Extra discount on large orders. SAE stocklist. Post & pack 20c. Custom Electronics, GPO Box 1452, Adelaide, SA 5001.

DISPLAY ADVERTS in MARKETPLACE are sold in multiples of one inch to a maximum of five inches. Rate $10.00 per inch per insertion, subject to continuity discounts.

CLASSIFIED RATES $1.00 per line per insertion payable in advance. Minimum two lines. A convenient form is provided in each issue.

CLOSING DATE is four weeks prior to the on-sale date. Issues are on-sale the first Monday of each month.

ADDRESS all classified orders, copy, enquiries, etc. to: The Advertising Manager, ELECTRONICS Australia, Box 2728 G.P.O., Sydney 2001.

TRANSCRIPTION turntable 15in dia, Byer, $50. 15 Whitford Road, Elizabeth Sth, SA.

WANTED

CIRCUIT or manual University VTVM model AST L. Ryan, 8 Belson St, East Malvern, Vic 3145.

AR 88 receiver instruction handbook no 19. Colin Gracie, PO, Cavendish, 3408.

HANDBOOK for Hallicraft 5X-110 receiver Mark 1A. Write to Mr S. W. Rawlins, 10 Pine Street, Peter borough SA 5422 or phone Petb 180 office hours.

READER SERVICE

TAPE to disc service. Take advantage of W and G Records professional experience when next needing a tape to disc service. W and G Record Processing Co, 185 A'Beckett St, Melbourne. Tel: 329 7255.

TV sync / pattern generator . . .

The video output signal available at the test pattern output connector of the SPG thus corresponds to the standard video format required by CCTV monitors and other equipment. It has negative sync polarity, an amplitude of 1.5V peak-to-peak of which 0.5V is sync, and a source impedance from T4 of approximately 75 ohms.

In passing it should perhaps be explained that the diodes shown in parallel with the series base resistor on transistors T2 and T3 are to ensure rapid switch-off of these transistors. By tying the bases of these transistors back to the low source impedance of the saturated transistors in the gates supplying the drive pulses, the diodes help to "suck" out charges stored in the base regions during saturated conduction.

In addition to the various output signals discussed so far, the SPG is also arranged to provide a CRO synchronising output. This output connector supplies either vertical or horizontal blanking pulses, selected by means of a front-panel switch. By feeding these pulses to the "external sync" or triggering input of a CRO, it becomes possible to obtain convenient and reliable locking of the CRO whenever examining any video signal, composite or otherwise, which is locked to the SPG.

This obviates many of the annoying problems often encountered when attempting to examine video signals with a CRO, and removes any need to use special sync separators, clamps, etc. Needless to say, because the CRO is synchronised to the leading edges of the blanking pulses, this makes it possible to examine the leading edges of the sync pulses in a video signal even when the CRO has no inbuilt delay line.

The actual circuit of the SPG will be given and discussed in the second of these articles, which will also describe its construction.

(To be continued)

Reader Information Service

Here is a convenient and easy way for you to get additional information about products or services advertised in this issue. Just fill out the coupon, stating the information you require, cut out the coupon and post to:

Reader Information Service, ELECTRONICS AUSTRALIA,
Box 2728 G.P.O., Sydney 2001

Note: Please list only one advertiser and one product on each coupon.

Post to: **ELECTRONICS AUSTRALIA,**
Box 2728 GPO, Sydney 2001

Advertiser .... Page ......

Product ....

Your Name ....

Address ....

.... Postcode ....

Position & Company 5/72

Post to: **ELECTRONICS AUSTRALIA,**
Box 2728 GPO, Sydney 2001

Advertiser .... Page ......

Product ....

Your Name ....

Address ....

.... Postcode ....

Position & Company 5/72

CLASSIFIED ADVERTISERS

To the Advertising Manager, ELECTRONICS Australia, Box 2728 G.P.O., Sydney. 2001

- Please insert the following advertisement in the .... issue
- Tick the classification required

☐ FOR SALE ☐ WANTED ☐ READER SERVICE ☐ POSITIONS

Please write in block letters with ink or ball-point pen. **Number of insertions** ......

Signed: ....

Residential Address ....

.... State ....

- I enclose P. Note / Cheque for $ .... being full payment for .... lines at $1.00 per line. (minimum 2 lines)

Index to Advertisers

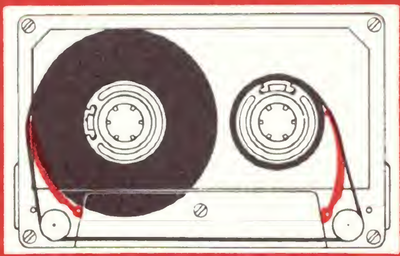
New: BASF chromium dioxide cassettes

Chromium dioxide Cr O_2 plus special mechanics

Special Mechanics
SM
Spezial Mechanik

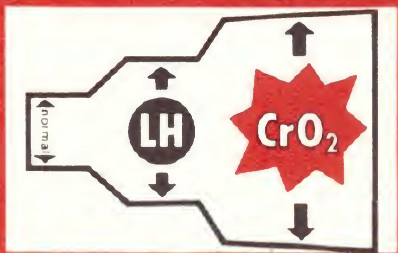
Improved tape transport

In a unique manner, BASF chromium dioxide cassettes correct certain deficiencies in conventional cassette transport systems. The new S. M. systems prevents the tape from sticking. Preclude wow and flutter. Insures trouble free running, even for extended – play cassettes.



astonishing new sound

Chromium dioxide is a quite different coating. Its extended dynamic range of the high end of the audible scale, plus the added feature of minimal head wear are qualities which you can appreciate while making your first challenging recording Top results which show a much increased high frequency response – are best achieved on tape decks with a CrO_2 switch.



BASF

BASF Compact Cassettes in chromium dioxide and LH quality

BA1695

ENROL NOW AND RECEIVE THE BENEFIT OF COLOR T.V TUITION

AUSTRALIA'S

ESTABLISHED ELECTRONICS COLLEGE

THE AUSTRALIAN RADIO & TELEVISION COLLEGE PTY. LTD.

- ESTABLISHED OVER 40 YEARS
- OVER 15 FULL TIME STAFF TO ASSIST YOU
- FULL NIGHT-CLASS PRACTICAL LESSONS

  OR
- EXTENSIVE CORRESPONDENCE TRAINING WITH SPECIAL PRACTICAL HOME-TRAINING KITS

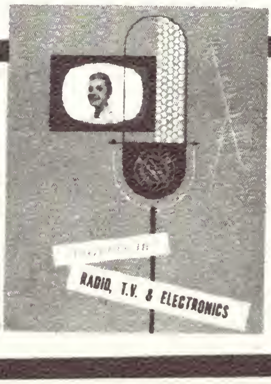
Mail Coupon NOW

- You are invited to mail the coupon below which can be your first step towards securing a job or business of your own with good prospects, security and big money. A.R.T.C. will mail to you by return, at no obligation to you the big free booklet: "Careers in Radio and Television". This booklet will show you definite steps you can take for a better job, how you can succeed in life. Post the coupon, phone or call NOW.

AUSTRALIAN RADIO AND TELEVISION COLLEGE PTY. LTD.

E.S.&A. BANK BUILDING

Cnr. Broadway and City Road, Sydney.
(Opp. Grace Bros). Phone 211-4244 (3 lines)



AUSTRALIAN RADIO & TELEVISION COLLEGE PTY. LTD.
206 Broadway, Sydney, N.S.W.

Dear Sir,
Please send me, without obligation, your free booklet, "Careers in Radio, TV and Electronics."

NAME..

ADDRESS..

....E205